Kadesky, K.M., C. Manarey, G.K. Blair, J.J. Murphy III, C. Verchere and K. Atkison. 1998. Cougar Attacks on Children: Injury Patterns and Treatment. Journal of Pediatric Surgery 33:863-865.

Purpose: Cougar attacks on humans appear to be on the rise. A review of all attacks on children was performed to determine the method of attack and injury patterns so that a treatment regimen as well as possible preventative measures could be determined.
Methods: A review of all attacks, including attacks on children, was performed, including three recent attacks treated at our institution. Situation, adult supervision, patient age, injuries recorded, survival, and mode of attack, if known, were reviewed.
Results: There were 50 documented attacks on children with a 25% fatality rate. Most children were not alone at the time of the attack (92%), and in many instances adult supervision was present or nearby. Severe head and neck lacerations along with puncture wounds were the most common injury. Examples of typical cervical injuries include a nonfatal vertebral artery injury, phrenic nerve injury, a fatal internal carotid artery injury, and a fatal cervical spine injury. The cougar was rabid in two cases. *Pasteurella* resulted in late infections in two patients.
Conclusions: Based on the pattern of injuries, the authors recommend aggressive evaluation for occult cervical injuries as well as surgical debridement. Antibiotics should cover oropharyngeal flora including *Pasteurella multocida*. Rabies prophylaxis is indicated. Adult supervision in wilderness areas is not necessarily protective.

Kamler, J.F., R.M. Lee, J.C. deVos Jr., W.B. Ballard, and H.A. Whitlaw. 2002. Survival and Cougar Predation of Translocated Bighorn Sheep in Arizona. J. Wildl. Manage. 66(4):1267-1272.

Abstract

We estimated survival and cause-specific mortality of 395 translocated bighorn sheep (*Ovis canadensis*) in Arizona, USA, from May 1979 to November 1997. To investigate regional and temporal trends, we compared survival among disjunct populations in 4 regions in Arizona (Northwest, Southeast, Southwest, Central) during 3 time periods: 1979-1985, 1986-1991, and 1992-1997. Survival did not differ among periods in the Northwest ($P = 0.50$) and Southeast ($P = 0.78$) regions, and ranged from 0.80 to 0.88 and 0.76 to 0.82, respectively. In contrast, survival decreased in the Southwest ($P < 0.01$) and Central ($P < 0.01$) regions, and ranged from 0.44 to 0.79 and 0.42 to 0.83, respectively. Cougar (*Puma concolor*) predation was the most important source of mortality (66%). Our results suggest that recent increases in cougar predation in most areas of Arizona may be responsible for declining bighorn sheep numbers. Recent population declines in mule deer (*Odocoileus hemionus*), the primary prey of cougars, may be responsible for recent increases of cougar predations on bighorn sheep in Arizona and other areas of western North America.

Kane, K.K., and W.J. Boever. 1976. An Evaluation of the Use of FVR C-P (Pitman-Moore Laboratories) Vaccine in Four African Lions and Two Mountain Lions. Proc. AAZV, Pgs. 45-49.

CONCLUSION

Several premises have been drawn from the study. First, there appeared to be no ill effects with the use of the FVR C-P vaccine when administered intramuscularly in the four African lions and the two mountain lions. Secondly, the response of the trivalent vaccine was significant. Three out of four seronegative exotic felines responded to the Rhinotracheitis component of the vaccine, while four out of four seronegative felines responded to the Calici Virus component of the vaccine. In addition, three out of four of the exotic cats developed or increased their titers of the Panleukopenia Antigen of the vaccine. In regards to the FVR component of the vaccine it is thought that a 13-day interval between vaccines is not as desirable as a 21-day interval which is recommended by the manufacturer. This may be a factor as to why the one African lion did not develop a detectable titer to the Rhinotracheitis portion of the vaccine. There is not enough information to comment on whether a double dose of this vaccine is more desirable than a single dose. Obviously, it is evident that further data is needed to adequately assess the value of this vaccine in these and other exotic feline species.

Kanta, J. 2008. South Dakota Mountain Lion Report. Page 91 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 lions historically occurred in South Dakota but were nearly extirpated in the 1900s due to bounties and unregulated hunting on this animal from 1899 to 1966. Since receiving legal protection in 1978, the population has reestablished in the Black Hills of South Dakota. South Dakota Game, Fish and Parks (SDGF&P) has invested a large sum of money and time to conduct research on mountain lions to determine population size and distribution, evaluate population fitness, evaluate the effects of sport harvest, and assess genetic structure of lions and numerous other objectives. Based on this extensive research as well as other information SDGF&P collects, the Department offered a limited harvest on cougars in 2005 as well as 2006 and 2007. SDGF&P has collected data on lion mortality since 1996 with a total of 233 mortalities documented to date. SDGF&P began recording mountain lion reports in 1995 and continues to collect these data on a yearly basis.

Katnik, D.D., J. Almack, R. Clarke, H. Robinson and R. Wielgus. 2003. Mountain Lion Predation on Endangered Woodland Caribou, Mule Deer, and White-tailed Deer. Page 63 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

The last population of woodland caribou (Rangifer tarandus) in the contiguous United States has been declining despite efforts to recover it through augmentation. Mule deer (Odocoileus hemionus) have been declining, also. Mountain lion (Puma concolor) predation may be the primary cause of mortality, possibly because an abundance of white-tailed deer (O. virginianus) is sustaining a high lion population. Our objectives were to determine 1) seasonal overlap and movements of lions and their ungulate prey; 2) the role of lion predation in survival and population decline in caribou and mule deer; 3) whether all or only specific lions kill caribou; 4) the effect of removing “caribou-killing” lions on caribou survival rates; and 5) the influence of forest cover types and fragmentation on lion predation. Since 1997, we have radio-collared 28 lions, 52 caribou, 43 mule deer, and 28 white-tailed deer in the 3,465 km^2 caribou recovery zone. Mule deer and lions both moved to higher elevations during late summer when most caribou mortalities occurred. Lion predation accounted for 23-83%, 55%, and 40% of caribou, mule deer, and white-tailed deer deaths, respectively. Only 2 lions (1 M, 1 F) overlapped spatially with caribou although most of the lions' home ranges were adjacent to caribou areas. One male lion killed 3 caribou and was removed in Spring 2000. This study will continue through 2001. We will present preliminary analyses of seasonal movements in relation to elevation, habitat selection by lions, and effects of forest fragmentation on lion predation of caribou.

Kautz, R. 1994. Historical Trends Within the Range of the Florida Panther. In: Dennis Jordan, ed., Proc. of the Florida Panther Conf., USFWS. 8pp.

Based on a GIS analysis of habitat use, Florida panthers prefer forest habitats, particularly cypress swamp, hardwood hammock, hardwood swamp, and pinelands. Statewide, forest habitats declined 4.30 million acres, or 21 percent, in the 51-year period from 1936 to 1987. This may have been enough habitat to support 35-70 male and 100-200 female Florida panthers. In a 10-county region of south Florida, forest lands declined 0.98 million acres between 1936 and 1987. All of the forest land converted to other uses came from the lands classified as commercial forest land, whereas lands classified as non-commercial forest land showed no decrease over time. Between 1949 and 1987, marsh land in south Florida decreased by 1.39 million acres. Between 1959 and 1987, cropland increased by 0.65 million acres, pasture increased by 0.53 million acres, and urban area increased by 0.71 million acres. Within a five-county area of southwest Florida that includes the current range of the panther, 92 percent of commercial forest land, which comprises important habitat for the panther, was in private ownership in 1987. A GIS analysis of ownership patterns revealed that 67 percent of the four vegetation types most preferred by the Florida panther were in private ownership in 1994. Cypress-gum forests accounted for 59 percent of the forests on commercial forest lands in southwest Florida, pine forests accounted for 32 percent, and hardwood forests accounted for 9 percent in 1987. Hardwood forests, which are the most important habitat types for panthers, are also the most rare forest type and are more likely to occur on private land. Sawtimber- and poletimber-size stands comprised 68 percent of commercial forest lands in southwest Florida whereas sapling, seedling, and nonstocked sites comprised 31 percent in 1987.

Kautz, R., R. Kawula, T. Hoctor, J. Comiskey, D. Jansen, D. Jennings, J. Kasbohm, F. Mazzotti, R. McBride, L. Richardson and Karen Root. 2006. How Much is Enough? Landscape-Scale Conservation for the Florida Panther. Biological

Conservation 130(1):118-133.

Abstract

The Florida panther (*Puma concolor coryi*) is an endangered, wide-ranging predator whose habitat needs conflict with a rapidly growing human population. Our goal was to identify specific regions of the south Florida landscape that are of high conservation value to support a self-sustaining panther population. We used compositional and Euclidean distance analyses to determine relative importance of various land cover types as panther habitat and to investigate the role of forest patch size in habitat selection. A model of landscape components important to Florida panther habitat conservation was created. The model was used in combination with radio telemetry records, home range overlaps, land use/land cover data, and satellite imagery to delineate Primary and Secondary zones that would comprise a landscape mosaic of cover types sufficient to support a self-sustaining population. The Primary Zone generally supports the present population and is of highest conservation value, while the Secondary Zone is of lesser value but could accommodate expansion of the population given sufficient habitat restoration. Least-cost path models identified important landscape linkages, and model results were used to delineate a Dispersal Zone to accommodate future panther dispersal outside of south Florida. We determined that the three habitat zones could support 80–94 panthers, a population likely to persist and remain stable for 100 years, but that would be subject to continued genetic problems. The Primary, Dispersal and Secondary zones comprise essential components of a landscape-scale conservation plan for the protection of a viable Florida panther population in south Florida. Assessments of potential impacts of developments should strive to achieve no net loss of landscape function or carrying capacity for panthers within the Primary Zone or throughout the present range of the Florida panther.

Keefover-Ring, W. 2005. State of Pumas in the West: Heading Towards Overkill? Page 213 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

Extraordinarily asocial, at times fiercely territorial and secretive, mountain lions *(Puma concolor)* are subjected to liberal hunting and trapping regulations in western states-they are afforded few protections in the states were they persist. Yet, little population data exist. Although highly charismatic and important in top-down ecosystem regulation, few governmental or nongovernmental entities expend resources to protect, much less study them because of the expense. Add to that, growth and sprawl and roads contribute to their direct or indirect mortality. States must take steps to protect mountain lions in the near future to avoid their extirpation. Between 1982 and 2003, western states showed a four-fold increase in sport hunter lion kills across the West. The upward trend is particularly noteworthy in Idaho, Colorado, Utah, and Montana for the years 1997 to 2001- although both Colorado and Montana have recently taken steps to curb hunting quotas. The upward trend is particularly noteworthy in Idaho, Colorado, Utah, and Montana for the years 1997 to 2001-although both Colorado and Montana have recently taken steps to curb hunting quotas. In contrast, most other western states (Arizona, Idaho, Nevada, New Mexico, Oregon, Texas, Utah, and Washington) through politically appointed wildlife commissions or through state legislatures, seek higher hunter-induced puma kills. States achieve these results through permissive hunting regulations such as inexpensive hunting tags, increasing the length of the hunting season, and liberalizing the number of cats hunters can take per year. It cannot be overemphasized: pumas are sensitive to overhunting and destruction of their habitat; yet, few states offer safeguards (i.e. science-based hunting quotas, protections for females and their young, and timely reporting of hunter success) to prevent overkill of pumas.

Keefover-Ring, W. 2005. Beast in the Garden: A Parable in Support of Anachronistic Thinking Regarding a Predatory Animal. Page 214 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

David Baron's Beast in the Garden: A Modem Parable of Man and Nature uses sloppy methodology, takes leaps in logic, and invents history. Unfortunately Beast has succeeded in unnecessarily frightening the public and generating numerous

glowing reviews. Baron argues that Boulder, Colorado's hippy-bred, animal venerating culture led to an "inevitable" mountain lion attack on a young man in Idaho Springs. Wildlife lovers on Boulder's rural-urban interface encouraged deer into their unhunted "gardens". The "increasing" deer population attracted lions (the "beast") closer to human habitants. He maintains humans created habituated cats. In other words, Boulder's culture of animal/nature reverence killed Lancaster. Beast's fundamental underpinnings are easily contested, unsound ethical reasoning further compounds the book's flaws, and Baron makes several unsupported historic claims. While David Baron believes that his book is a "balanced" account, it leaves the discerning reader questioning his intent. Beast in the Garden comes rife with inaccuracies and inventions, an anti-predator bias, and a failure to provide critical information. Beast's anachronistic thinking returns us to the turn-of-the-nineteenth century, the time when the dominant American culture-conservationists included- believed that predators were evil and ravenous and we (and deer) were innocent victims.

Kellert, S.R., M. Black, C.R. Rush, and A.J. Bath. 1996. Human Culture and Large Carnivore Conservation in North America. Conservation Biology 10(4):977-900.

Abstract

We examined and compared human attitudes towards wolves (*Canis lupus*), grizzly bears (*Ursus arctos horribilis*), and mountain lions (*Puma concolor*) in North America, with an emphasis on the Rocky Mountains of the United States and Canada. Primary research, literature review, and secondary data were included in the analysis. Wolves were historically persecuted by Euro-American settlers, but they have been the focus of a significant attitudinal transformation during the latter half of this century. Many now view the wolf in positive and protective ways. Considerable variation remains, however, in contemporary attitudes. Attitudes towards mountain lions have been highly ambivalent, never assuming the prominence or clarity of views on wolves. The behavior and physiology of the species, along with human psychological factors, are important reasons for the differences in human perceptions of wolves and mountain lions. We also examined attitudes towards grizzly bears. Many indigenous cultures revered grizzly bears, although European settlers were interested in exploiting and eliminating them. Today, perceptions of grizzly bears range from positive to negative. Our recommendations include targeting key groups with education programs, building support through the use of spokespeople within the target groups, integrating human and ecological concerns, and designing species-specific education initiatives in some cases.

Kelly, M.J. and H.B. Camblos. 2006. Estimating Puma Densities with Remote Cameras. Page 117 in H.J. McGinnis, J.W. Tischendorf and S.J. Ropski editors. Proceedings of the Eastern Cougar Conference 2004, Morgantown, West Virginia, USA.

Abstract

The elusive, solitary, wide-ranging, and often, nocturnal behavior of free-living pumas make them difficult to study and/or survey. In addition, pumas have only subtle markings making individuals difficult to distinguish. As a result, little is known about puma densities in the wild. We used remotely triggered cameras to survey pumas in the Chiquibul Forest Belize, Central America in 2002-2003. Cameras were placed in grid-like formation with 3-km interval spacing between camera-trapping stations. Each station consisted of an opposing pair of cameras that were operational 24 hours a day for 30-90 days per survey. Individual pumas were distinguished in photographs by subtle markings in the coat patterns (especially tail tips and undersides of legs) and scaring patterns. Capture histories were established for each individual and mark-recapture statistics (specifically program CAPTURE) used to estimate puma numbers. These population size numbers were then divided by the effective area surveyed to determine puma density. Puma density ranged from 2.57 to 6.83 per 100 km^2. This study demonstrates the effectiveness of remote cameras for density estimation of pumas and highlights the potential for application of this technique to puma populations in other parts of the world.

Kelly, M.J., A..J. Noss, M.S. Di Bitetti, L.Maffei, R.L. Arispe, A. Paviolo, C.D. De Angelo, and Y.E. Di Blanco. 2008. Estimating Puma Densities from Camera Trapping across Three Study Sites: Bolivia, Argentina, and Belize. J. Mammal. 89(2):408–418.

Abstract

Estimates of abundance are extremely valuable for species conservation, yet determining abundance for elusive, wide-ranging, carnivores is difficult. We estimated density of pumas using remote cameras across study sites in Bolivia, Argentina, and Belize. We used obvious and subtle markings to identify individual pumas in photographs and conducted double-blind identifications to examine the degree of agreement among investigators. Average agreement on identification between pairs of investigators was nearly 80.0% and 3-way agreement was 72.9%. Identification of pumas as different individuals was uncommon (7.8% pairwise, 0.69% 3-way disagreement) with the remainder described as unidentifiable. Densities of pumas varied consistently from site to site regardless of investigator. Bolivian pumas moved the shortest distances between camera stations and Argentinean pumas the longest, but distances among cameras and area covered by surveys varied among sites. We applied a correction factor to the Bolivian data to account for the small area surveyed and found that, averaged across investigator, Bolivia had significantly more pumas per 100 km^2 (mean ± SD; 6.80 ± 1.5) than Belize (3.42 ± 1.3) or Argentina (0.67 ± 0.2). Numbers of pumas in Argentina match those of low-density North American sites, and those for Belize are consistent with the Pantanal and high-density North American sites. Densities of pumas can be reliably estimated with remote cameras for these sites, and our work presents the 1st density estimates for Central America and for forested environments in South America.

Kenn, S. 2004. Methodology and Interpretation of Puma (Puma concolor couguar NA) Territories in Ontario.

Summary

Based on data that I have researched since 1979, the population trends indicate that the puma population is on the rise. My approximations were as follows: 1979 (80), 1982 (100), 1988 (160), 2003 (300), 2004 (550). It takes approximately 20 years for a puma population to double in size but other possible factors may affect these numbers such as an increasing population of people heading into more isolated areas of the province resulting in more sighting, harvesting of forests have opened new areas for deer habitat and as a result, pumas that depend on big game, particularly deer, have coincided their expansion with them, (Wright, 1959), developing park land and education. Interpretation of information will be different for every individual and therefore the accuracy and shape of the territories will be different. However, in order for this methodology to serve as a tool for future studies, the accuracy should at least be within a 5% margin of error if it is to be useful. The shape of the polygon may vary slightly from one interpretation to the next but if it appears to be altogether different then this methodology should not be used or at least reassessed for further testing.

Kenn, S. 2007. The Ontario Puma Foundation: An Organization for Everyone. Page 4 in Abstracts of Presentations of the 3rd Midwestern-Eastern Puma Conference, Trent University, Peterborough, Ontario.

Abstract

The Puma once ranged across North & South America from the Pacific to the Atlantic Oceans in all varieties of habitat. After the European settlement in North America, the Puma was persecuted resulting in the disappearance of the species from much of its range. Although at one time the Puma was considered extirpated in Ontario several sightings over the past 100 years have brought insight into the possibility that it still exists. The question is whether this species has repopulated its original range from a remnant indigenous stock or whether it is escaped exotics or possibly a transient immigration from the west expanding its range eastward to fill a niche. Currently there is no consensus on the distribution or population of the Puma in Ontario. In the spring of 2002, a group of people interested in the research and recovery of the Puma in Ontario discussed the possibility of forming an organization. Collaborating their information from several years of sightings, the objectives and strategies were evolved and the Ontario Puma Foundation was born. Today the Ontario Puma Foundation has collected and investigated hundreds of sightings, a small number of hair and scat samples for DNA analysis, and a few track photos that have been confirmed to be puma. The data that has been collected has assisted the OPF with the development of a draught Recovery Strategy and Management Plan for the province. This plan has been developed with the assistance of other puma organizations, puma researchers, biologists, zoologists, hunters, trappers, farmers/livestock owners, naturalists, and other interested parties. Cooperation from people with all of these backgrounds and skills is in our opinion, the most productive method for the recovery and management of this endangered species.

Kenn, S. 2007. Puma Recovery Strategy and Management Plan for Ontario, September 30, 2007. For the Province of Ontario, Canada, 1 Draught.

Executive Summary

The puma or cougar (*Puma concolor couguar*) once ranged across North America, including Ontario, in all varieties of habitat. After the European settlement of North America the puma was persecuted resulting in the disappearance of the species from much of its range.

The puma was ranked "Data Deficient" in 1998 by COSEWIC. It was originally federally listed as "Endangered" in 1978 and again in 1986. An update under the federal Species At Risk Act is warranted. The puma was listed in regulation under Ontario's Endangered Species Act, 1990, which protects regulated species and their habitats. It is currently listed as "Endangered-R" by OMNR-NHIC as of 1996. The update to the Ontario Endangered Species Act, 2007 is currently undergoing a review, and is to come into force on June 30, 2008. The puma needs to be properly listed under the updated Act.

This 1 Draught of the Recovery Strategy and Management Plan for puma has been prepared in cooperation with the members of the Ontario Puma Foundation (OPF) in the province of Ontario, Canada. The first part of this document contains suggestions for recovery strategies and the second part contains short and long-term management plans.

The recovery team must document the current status of the puma using all kinds of data, including DNA analysis - where possible - of hard evidence to establish an accurate population and distribution estimate for Ontario. If the data suggests a viable population, the following recovery strategies should be used for the conservation of the species in Ontario. Evidence will be reviewed by the recovery team to determine its validity, as well as analysed in hope of determining distribution, trends, Areas of Special Concern (ASC), population densities, and potential areas of conflicts with humans or livestock.

Although the numbers of purported sightings in Ontario have increased noticeably since the 1950's, population estimates may not be possible with the current data because this data cannot be isolated from variations in the number observers or in the lack of reports submitted.

The recovery team will follow the goals of the "Recovery Plan" to bring this species back from the risk of extinction to a self-sustainable population level, able to withstand stochastic events and other environmental variables. Habitat requirements and limitations should be determined so that a plan for recovery can be employed. Habitat loss, degradation, and fragmentation are among the greatest threats to puma survival.

The recovery team will encourage the protection of large wilderness tracts where suitable puma habitat exists. The key to maintaining a healthy puma population in managed forests is to ensure that large areas of quality puma habitat are maintained across the region. Establishing a sustainable breeding population requires a supply of breeding adults, sufficient quality habitat, adequate or improving demographic parameters, and mitigation/control of threats to the population, particularly those that initially caused the species' decline.

In Ontario there are numerous human elements that may hinder the progress of the recovery of the puma. The recovery team's Educational Programme will utilize a number of methods to educate the residents of Ontario and wildlife professionals on living with pumas. Predators play a key role in maintaining ecosystem integrity in terms of species and genetic composition, ecosystem functions, and long term stability.

Passive, non-aggressive methods of monitoring should be used, where feasible to minimize harassment, injury, or mortality of pumas while conducting research and monitoring programmes. It is important that qualified and experienced personnel are present during inventory surveys.

In Ontario the puma's main food source is white-tailed deer (*Odocoileus virginianus*). Chronic wasting disease or other ungulate diseases could have an adverse affect on a recovering population of pumas in Ontario and therefore it must be addressed as part of the recovery team's recovery strategies.

The Ministry of Natural Resources should recognize the threat of predation to livestock by pumas within Ontario; and further that the Ministry of Agriculture and Food initiate a programme of compensation to livestock owners for predation by these pumas within Ontario.

Although extremely rare, on occasion a trapper may inadvertently capture a puma in a snare or leg hold trap that has been set for other species. Under the Endangered Species Act a resolution should be made to protect trappers from prosecution from killing a trapped puma.

The Puma Recovery Strategy and Management Plan for Ontario has been written as a sequence of events that should take place in order to bring back the puma from the risk of extinction. In the end, the puma in Ontario should have a self-sustainable population level with a sustainable breeding population and connected to allow for sufficient genetic exchange. Following this document is an "Action Plan" that may used by a "Recovery Team" in order to fulfill the objectives for this document.

The puma has long been considered a creature of myth and mystery. It is hoped that by working together in partnership, all of us can help usher this remarkable cat out of the mists of legend and into our livers as an integral component of a

healthy ecosystem.

Kennedy, G.A. and A.C. Strafuss. 1976. Multiple Neoplasia in an Aged Cougar. J. Zoo Animal Medicine 7(I):24.

SUMMARY

The most striking of multiple necropsy lesions found in an 18-year-old cougar (Felis concolor) was a bilateral adenocarcinoma of the thyroid. Other lesions included a bile duct carcinoma in the liver, an adenocarcinoma in the lung, cholesterol pneumonitis, nodular hyperplasia of the adrenal cortex, accessory adrenal cortical tissue, chronic interstitial nephritis, and a malacic focus in one cerebral hemisphere. The animal was in good flesh but had been lethargic and lame in both hind legs before it was found dead in its cage. Adenocarcinomas of the thyroid appear to be relatively rare in felines. Of those reported, advanced age seems to be a common finding. This report describes an adenocarcinoma of the thyroid in an 18-year-old cougar (Felis concolor). In addition to various age-associated lesions, carcinomatous foci apparently unrelated to the thyroid tumor, were found in the liver and lung.

Kerkhoff, A.J., B.T. Milne, and D.S. Maehr. 2000. Toward a Panther-Centered View of the Forests of South Florida. Conservation Ecology 4(1):1.

Abstract

Anthropogenic habitat degradation and loss is the single largest threat to the endangered Florida panther, *Puma concolor coryi.* Conservation of the subspecies must be undertaken on the scale of the entire landscape. Thus, a view of the forested landscape of South Florida must be developed that is meaningful with reference to the panther. We approach this problem by analyzing the spatial interactions of panthers and forests at multiple scales. We apply tools derived from fractal geometry to the analysis of 12 years of telemetry observations of panthers and remotely sensed forest cover imagery. A fractal characterization extends conventional scale-dependent measures of forest density and relates intuitively to panther ecology. To move toward a panther-centered view of the forests of South Florida, we adopt a scale-dependent notion of association and compare the density of forest cover associated with panther locations to that of the forest at large. Panthers interact with forest cover over a wide range of scales, consistently selecting denser than average forest areas. We discuss landscape-scale management of the panther in light of our findings and propose a protocol for mapping forest cover with reference to the panther at multiple scales as a management tool for habitat assessment.

Kertson, B.N. 2005. Political and Socio-Economic Influences on Cougar Management Legislation in Washington State: Post Initiative 655. Pages 92-103 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

In November of 1996, Washington State voters approved Initiative 655 (I-655) prohibiting the use of dogs to hunt or pursue cougars *(Puma concolor).* I-655 has initiated increased awareness, public safety concerns, and legislative activity surrounding cougars in Washington State and has highlighted differing opinions of cougar management in eastern and western regions of the state. I compared population and economic data for western and eastern Washington counties with the highest reported cougar-human interaction in an attempt to describe and understand the social values and political context of cougar management legislation in Washington after I-655. I searched newspaper and television news archives to characterize how cougars and cougar management are presented to the public and to judge its potential role in the legislative process. Washington's northeastern counties (Chelan, Okanogan, Ferry, Stevens, and Pend Oreille) have significantly lower human population levels, lower household and family incomes, higher unemployment, a greater percentage of families and individuals living in poverty, and a higher percentage of people working in forestry, fisheries, and farming than counties in western Washington (King, Pierce, Snohomish, Thurston, Skagit, and Whatcom). These results suggest Washington's five northeastern counties are rural, resource-based communities with political and social values that differ from those of the more populated, urban counties to the west. Search results of Washington newspaper and television news archives indicated greater coverage of cougar-human interaction (61.6% of media reports) and few

reports of cougar science (12.3% of media reports). Since 1996, media coverage of human-cougar interactions and utilitarian views of northeastern county residents and politicians has contributed to eight legislative attempts to overturn all or part of I-655. The most recent attempt, Substitute Senate Bill 6118, has successfully authorized the use of dogs to hunt and pursue cougars in Washington's five northeastern counties. The passage of this bill in light of increasing cougar harvest rates, documented declines in northeastern cougar populations and a decline in cougar complaints relative to pre I-655 levels, suggests that cougar management legislation in Washington may be influenced by political and social factors and may not reflect a scientific understanding of cougar ecology and behavior.

Kertson, B.N. and C.E. Grue. 2005. Cougars and Citizen Science: Evaluating Accuracy of Data Collected by Student Volunteers on Cougar Ecology-Preliminary Findings. Page 209 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

Field investigations of cougar *(Puma concolor)* often face challenges stemming from budget limitations and staffing shortages. Citizen science is the use of trained volunteers to collect scientific data and information on wildlife and their habitats as a means to meet research and management objectives. If citizen science is to be accepted as a viable resource to assist wildlife biologists in cougar research and management activities, questions of data quality must be addressed. As part of an ongoing investigation of citizen science data quality, we evaluated the ability of 3rd, 5th, and 8th grade student volunteers from the Cle Elum/Roslyn School District to collect accurate scientific data and information on cougar ecology as part of the Washington Department of Fish and Wildlife's Project CAT (Cougars and Teaching). Students were evaluated setting up and completing winter track transect surveys and spring habitat plots. Citizen scientists and researchers conducted 100 meter track transect surveys during the winter from student homes in an attempt to characterize wildlife distribution (focusing on cougar prey species) in different densities of residential development. In the spring, students and researchers quantified and characterized wildlife habitat in the Project CAT study area focusing on attributes of ungulate ecology and winter range. Student citizen scientists received eight hours of training for set up and completion of winter work and 5 hours for spring habitat plots. Training was provided in the classroom and field by teachers with advanced training provided by N*atureMapping* Program partners and project researchers. We used paired t-tests, frequency distributions, and descriptive statistics to compare citizen scientist and researcher datasets. Preliminary results of the Year 1 winter and spring evaluations indicate the ability of student citizen scientists to set up experiments and collect accurate scientific data are variable. Citizen scientist datasets did not differ from researchers for several tasks, but students struggled with portions of setting up experiments, track identification, plant identification" and the concept of scientific bias. Overall, the use of K -12th grade students working as citizen scientists to assist biologists and managers with cougar research and management objectives appears to hold promise. Logistical concerns (volunteer training, coordination, and supervision) may pose a greater challenge to the use of citizen scientists in investigations of cougar than concerns of data quality. Beyond scientific data collection" the greatest benefit of utilizing students as citizen scientists stems from increased community support for, and understanding of, cougar ecology, conservation, and research objectives.

Kertson, B.N., R.D. Spencer and C.E. Grue. 2008. Demographic and Landscape Influences on Cougar-Human Interaction in Western Washington. Page 111 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

Cougar (*Puma concolor*)-human interaction, defined as a sighting, encounter, depredation, or attack, is an increasing concern for wildlife managers. Washington has experienced high levels of interaction since 1996 (>350 confirmed reports per year) and the Puget Sound region is a microcosm of cougar management issues occurring throughout western North

America. Cougar population increases are frequently cited as the reason for higher levels interaction, but there is little evidence to support this assertion. Alternative explanations may be found in cougar-habitat relationships and the behavioral differences between different demographic classes of cougar. We are in year three of a proposed four-year study examining the role of landscape features and cougar demographics as possible contributing factors to cougar-human interactions. Cougars are captured, outfitted with Global Positioning System (GPS) radio collars, and intensively monitored year-round using radio telemetry and GPS. All reports of cougar-human interaction within the study area received by the Washington Department of Fish and Wildlife are investigated, landscape features documented, and demographic information is collected if possible. We are utilizing multivariate Resource Utilization Functions (RUF), Geographic Information Systems (GIS), and paired t-tests to examine the relationship of various landscape features and characteristics to cougar space use, movements, and interactions with people. We are utilizing ANOVA fixed-effects models and the RUF methodology to examine the propensity of different demographic classes to interact with people. To date, we have captured 31 adult and subadult cougars and 21 of 23 individuals (cougars captured prior to winter 2007-2008) have utilized the urban-wildland interface and suburban environments to some extent. Preliminary findings suggest use of the urban-wildland interface may increase in proximity to rivers, streams, and wetlands and that all demographic classes of cougar interact with people. Research findings should assist wildlife managers and urban planners with the development of direct and indirect management strategies and education efforts that work to minimize cougar-human interaction, improve management, and foster an attitude of coexistence.

Kertson, B.N., R.D. Spencer and C.B. Richards. 2008. Safety and Effectiveness of Cage Traps for the Capture of Cougar. Page 254 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

Safe and effective capture of cougar (*Puma concolor*) is a critical component of successful research and management efforts. Use of trained dogs provides an efficient and effective means to capture cougar, but may result in serious injury or death to animals or project personnel. As part of an ongoing study of cougar-human interaction in western Washington, we are utilizing large (1.3m x 1.3m x 3m), steel cage traps to supplement capture efforts using dogs. From Dec. 1-Mar. 31 traps are placed in areas of known cougar use and baited with road-killed black-tailed deer (*Odocoileus hemionus columbianus),* elk (*Cervus elaphus*), or nuisance-trapped beaver (*Castor canadensis*). Traps are concealed using vegetation and materials found on site and one of two varieties of commercial scent lure are applied to surrounding trees . To date, we have captured a total of 9 cougars (7 males, 2 females) 14 times. Catch per unit effort (CPUE) has been variable: 2004-2005: 1 cougar/34 trap nights; 2005-2006: 1 cougar/50 trap nights; 2006-2007: 1 cougar/72 trap nights. Use of cage traps for scavenging cougar has a male bias ($\chi^2 = 4.571$, $P = 0.38$, 1 df), and individual males can be captured multiple times whereas females are unlikely to be recaptured. An additional 3 cougars (all female) were captured with traps baited using cougar-killed deer, elk, or livestock. Injuries associated with cage traps were infrequent and most often consisted of minor cuts and abrasions to the head and face and minor damage to the front claws. Claw damage was eliminated with the placement of a layer of felt, 1.4cm plywood, or vegetation/dirt on the floor of the trap. Only one tooth breakage associated with the use of the cage has been documented with an adult female breaking < 2.0 cm of an upper canine. Advantages of cage traps include ease of use, year-round use, and increased safety for project personnel and captured cougar. Disadvantages include size and weight of traps, limited placement of traps beyond road edges, and initial cost for trap construction (~$4500-$6500). Overall, we believe cage traps provide a very safe and effective means to capture cougar for research and management projects and can be valuable tools to supplement capture efforts with dogs.

Kikuchi, Y., B.B. Chomel, R.W. Kasten, J.S. Martenson, P.K. Swift and S.J. O'Brien. 2004. Seroprevalence of *Toxoplasma gondii* in American free-ranging or captive pumas (*Felis concolor*) and bobcats (*Lynx rufus*). Veterinary Parasitology 120(1-2):1-9.

Abstract

Toxoplasma gondii is a major zoonotic agent infecting a wide range of mammals, including wild felids. Like domestic cats, wild felids are involved in the complete infective cycle of *T. gondii*, as they can host in their gastrointestinal tract sexually mature parasites and shed infective oocysts in their feces. In order to evaluate the importance of this wildlife reservoir, 438 serum samples collected between 1984 and 1999 from 438 pumas (Felis concolor) and from 58 bobcats (Lynx rufus) from North America, Central America and South America were screened for antibodies to *T. gondii*. The overall prevalence of *T. gondii* antibodies was 22.4% in pumas and 51.7% in bobcats, with regional variations. Adults were more likely to be seropositive than juveniles and kittens (prevalence ratio (PR)=2.15; 95% confidence interval (CI)=1.15, 4.04). In the US, pumas from the southwestern states (Arizona, California and New Mexico) were more likely to be seropositive for *T. gondii* (PR=2.61; 95% CI=1.32–5.18) than pumas from the northwestern and mountain states (Colorado, Idaho, Oregon, Utah and Wyoming). Male pumas from the US were more likely to be seropositive than females (PR=2.08; 95% CI=1.11–3.92), whereas female pumas from Mexico, Central America and South America were more likely to be seropositive than female pumas from Canada and the US (PR=2.49; 95% CI=1.09–5.69). Captive pumas were also more likely to be seropositive (21.7%, 29/92) for *T. gondii* than free-ranging animals (19.9%, 69/346) (PR=1.85; 95% CI=1.06, 3.17).

Kilgo, J.C., R.F. Labisky and D.E. Fritzen. 1998. Influences of Hunting on the Behavior of White-Tailed Deer: Implications for Conservation of the Florida Panther. Conservation Biology 12(6):1359-1364.

Abstract

The effects of deer hunting by humans on deer population dynamics and behavior may indirectly affect the population dynamics and behavior of deer predators. We present data on the effects of hunting on the behavior of white-tailed deer (Odocoileus virginianus) on the Osceola National Forest, a potential reintroduction site for the endangered Florida panther (Felis concolor coryi). We then use this information to formulate and recommend testable hypotheses to investigate whether these changes in deer behavior influence panther movements, mortality, and hunting success. We monitored 14 radio-collared deer from June 1990 through July 1991 to compare movement, activity, and habitat-use patterns between the hunting and nonhunting seasons. Mean distance of deer to the nearest road, mean distance of activity centers of diel home ranges to the nearest road, and mean nocturnal rate of activity were greater during the hunting than the nonhunting seasons. During the hunting season, deer avoided clearcuts, young pine plantations (4-10 years old), and other open habitats and preferred swamp and mature pine forests, both of which provided cover. These results suggest that deer responded to hunter disturbance by moving away from roads and increasing nocturnal activity. Although recreational deer hunting may reduce the prey base for panthers, the changes we observed in deer behavior during the hunting season may benefit panthers in the following ways: (1) an increase in nocturnal activity and movement away from roads by deer into areas frequented by panthers may increase prey availability for panthers; (2) the movement of deer away from roads may in turn draw panthers away from roads, which may decrease the chance of panthers being killed by vehicular traffic or poachers.

Kirkwood, J.K. and A.A. Cunningham. 1994. Epidemiological Observations on Spongiform Encephalopathies in Captive Wild Animals in the British Isles. Vet. Record 135(13):296-303.

Since 1986, scrapie-like spongiform encephalopathy had been diagnosed in 19 captive wild animals of eight species from eight zoological collections in the British Isles which included one puma (Felis concolor). This female puma had remained where she was born throughout her life and was separated from her dam at 10 months of age. Both parents died of non-neurologic diseases and her diet consisted of rabbit and chicken carcasses and parts of cattle carcasses deemed unfit for human consumption, including split spinal columns without heads with offals rarely offered. On one occasion, three months prior to the onset of clinical signs and 4½ months before her death, was fed meat from two eland that had been culled from the collection. These eland were born in 1988 and were fed commercially prepared cattle food. Although unconfirmed, the authors considered that this puma acquired the disease from (BSE) bovine spongiform encephalopathy-infected cattle tissue (Willoughby and others 1992).

Kisling, V.N., Jr. 1976. Captive Propagation and Study as an Integral Component of a Field-Captive Management Program for the Florida Panther, Felis concolor coryi. Pgs. 46-58 In: Proceedings of the Florida Panther Conference, P.C.H. Pritchard (ed.). Orlando, Fl. 121pp.

A brief presentation of the Miami Zoological Park Research Department demonstrates why the zoo would be a facility with the capability to assist in a Florida panther conservation program. The captive breeding project as a conservation technique is discussed. How captive propagation and study can be integrated with field studies to form a cooperative and unified conservation management program is considered.

Kistner, T.P., D. Wyse, and J.A. Schmitz. 1979. Pathogenicity Attributed to Massive Infection of Nanophyetus Salmincola in a Cougar. J. Wildl. Dis. 15:419-420.

An estimated 650,000 Nanophyetus salmincola were recovered from the small intestine of a wild female cougar kitten (Felis concolor). The trematodes stimulated marked mucosal thickening in the duodenum and jejunum and caused a marked enteritis. Malnutrition was listed as the cause of death due to impaired nutrient absorption resulting from combined effects of the diarrhea and thickening of the intestine.

Kluge, J.P. 1967. Trichinosis and Sarcosporidiosis in a Puma. Bull. Wildl. Dis. Assoc. 3:110-111.

There had been no prior reports of Trichinella spiralis larvae in the puma Felis concolor. Multiple cysts containing larvae were present within skeletal muscle bundles in the esophagus and tongue upon necropsy of a 13-year old male puma obtained from the National Zoological Park. The puma was purchased from a dealer in Colorado at six years of age and was fed a diet of primarily raw horsemeat and occasional raw beef during the seven years at the National Zoo. A few parasitic cysts with different morphological characteristics were present in skeletal muscle and the author believed these were caused by a member of the genus Sarcocystitis.

Knopff, K.H., A.A. Knopff and M.S. Boyce. 2008. Refining the Use of GPS Telemetry Cluster Techniques to Estimate Cougar (*Puma concolor*) Kill Rate and Prey Composition. Page 123 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

Recent advances in global positioning system (GPS) radio-telemetry technology have created promising new opportunities for increasing sample size and reducing field efforts when estimating parameters of predation for large carnivores. Clusters of relocations in close proximity obtained from GPS radiocollars deployed on cougar (*Puma concolor*) can be used to identify potential kill sites. The number of prey found by visiting all clusters in a monitoring period can be used to estimate kill rate directly, or models can be employed to indirectly estimate kill rate by identifying kill clusters from GPS data. Extending kill rate models to allow indirect estimation of prey composition in a multi-prey setting has been suggested, but not attempted. We used data from 1,735 visits to GPS telemetry clusters and 637 prey >10kg found at clusters in westcentral Alberta to further explore and refine indirect and direct GPS telemetry cluster techniques for cougar. We developed logistic regression models to identify kill sites (prey >10kg) from GPS data and multinomial regression models to identify the prey species at a kill cluster. The predictive capacity of each model was assessed using k-fold cross validation. The top logistic regression model had good classification success (86%), and 5-fold cross-validation at this cutoff revealed that it was capable of estimating cougar kill rate to within an average of +8.67% (SD = 5.56) of true values. The top multinomial model also had reasonable classification success (75%), but it over-predicted the occurrence of primary prey (deer) in the diet and under-predicted the consumption of alternate prey (e.g., elk and moose) by as much as 100%. Simulated visits to all clusters in our dataset with a model-estimated kill probability of 0.15 or higher revealed that we could reduce the number of clusters visited by as much as 50%, while still retaining 91.6% of all kill clusters. Although indirect GPS telemetry cluster techniques can be usefully applied for overall kill rate estimation, they poorly estimate diet composition. Therefore, we recommend using model-directed field visitation to estimate kill rate and prey composition for cougar in multi-prey systems.

Knopff, A.A., K.H. Knopff and M.S. Boyce. 2008. Cougar Scavenging Behavior and Susceptibility to Snaring at Bait Stations. Page 156 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

In western Canada, snares placed around carrion bait are commonly used to harvest wolves (*Canis lupus*). Snaring can be an indiscriminant harvest method that can include by-catch of several species, including cougar. Cougar are known to scavenge, but the degree to which it makes cougar susceptible to by-catch at bait stations has not been assessed. We present detailed information on cougar scavenging behavior and susceptibility to snaring at a study site in west-central Alberta. We monitored 32 cougar over 3 field seasons (2005-2008) using a combination of GPS and VHF radiocollars. During this period we visited 2,687 clusters of GPS locations for GPS radiocollared cougar and we snowtracked collared and uncollared cougar to locate predation or scavenging events. Scavenging events were recorded only if there was evidence at the site indicating that the monitored cougar did not kill the animal it consumed. We documented at least 53 scavenging events by 23 different cougar. Cougar of all age-sex classes participated in scavenging (47% of cougar scavenged at least once during monitoring). Twenty-nine cougar were monitored intensively with GPS radiotelemetry for continuous periods (29 – 649 days) which allowed us to estimate a scavenging rate for individual animals. Frequency of scavenging was highest for sub-adults (1.38 scavenging events/month) followed by females (0.83/month), and adult males (0.16/month). Scavenging rates for all cougar in winter (1.29 scavenging events/month) were more than 4 times higher than in summer (0.30 scavenging events/month). Seasonal variation in scavenging might be partially explained by carcasses being more readily available during winter at trapping bait stations and hunter-killed ungulate dump sites. Six monitored cougar visited and scavenged from bait stations. Two cougar (1 adult male and 1 adult female) were snared and killed, accounting for 25% of the humancaused mortality of radiocollared cougar during this study. Accidental snaring of cougar must be reported in Alberta and provincial records show that from January 2000 through March 2006, 11% of reported human-caused cougar mortality in our study area was the result of snaring. Our results indicate cougar, especially sub-adults, have a propensity to scavenge and that this behavior makes cougar susceptible to snares. Management plans for cougar in areas where snaring of wolves occurs should account for cougar mortality in snares.

Knopff, K.H., A.A. Knopff, M.B. Warren and M.S. Boyce. 2009. Evaluating Global Positioning System Telemetry Techniques for Estimating Cougar Predation Parameters. J. Wildl. Manage. 73(4):586-597.

Abstract

Using clusters of locations obtained from Global Positioning System (GPS) telemetry collars to identify predation events may allow more efficient estimation of behavioral predation parameters for the study and management of large carnivore predator–prey systems. Applications of field- and model-based GPS telemetry cluster techniques, however, have met with mixed success. To further evaluate and refine these techniques for cougars (*Puma concolor*), we used data from visits to 1,735 GPS telemetry clusters, 637 of which were locations where cougars killed prey >8 kg in a multi-prey system in west-central Alberta. We tested 1) whether clusters were reliably created at kill locations, 2) the ability of logistic regression models to identify kill occurrence (prey >8 kg) and multinomial regression models to identify the prey species at a kill cluster, and 3) the duration of monitoring required to accurately estimate kill rate and prey composition. We found that GPS collars programmed to attempt location fixes every 3 hours consistently identified locations where prey >8 kg were handled, and cluster creation was robust to GPS location acquisition failures (poor collar fix success). The logistic regression model was capable of estimating cougar kill rate with a mean 5-fold cross validation error of <10%, provided the appropriate probability cutoff distinguishing kill clusters from non-kill clusters was selected. Logistic models also can be used to direct visits to clusters, reducing field efforts by as much as 25%, while still locating >95% of all kills. The multinomial model overpredicted occurrence of primary prey (deer) in the diet and underpredicted consumption of alternate prey (e.g., elk and moose) by as much as 100%. We conclude that a purely model-based approach should be used cautiously and that field visitation is required to obtain reliable information on species, sex, age, or condition of prey. Ultimately, we recommend a combined approach that involves using models to direct field visitation when estimating behavioral predation parameters. Regardless of the monitoring approach, long continuous monitoring periods (i.e., >100 days of a 180-day period) were necessary to reduce bias and imprecision in kill rate and prey composition estimates.

Knopff, K.H., A.A. Knopff and M.S. Boyce. 2010. Scavenging Makes Cougars Susceptible to Snaring at Wolf Bait Stations. J. Wildl. Manage. 74(4):644-653.

Abstract

In western Canada it is illegal to trap or snare cougars (Puma concolor), but cougars are sometimes caught accidentally in snares placed near carrion baits, a technique commonly used by trappers to harvest wolves (Canis lupus). We studied cougar foraging ecology and survival in west-central Alberta to estimate the propensity for cougars to scavenge, their susceptibility to snaring at trapper bait stations, and the implications these have for managing cougar populations. During 2005–2008, we used data from visits to 3,407 Global Positioning System (GPS) location clusters and >400 km of snow tracking of 44 cougars to locate foraging events and calculate scavenging rates. We identified 83 instances of scavenging, and 64% of monitored cougars scavenged at least once. Scavenging rates were higher in winter (0.12 events/week) than in summer (0.04 events/week), reflecting seasonal variation in carrion availability. Individual cougars scavenged at different rates, and winter feeding on carrion occupied up to 50% of total carcass handling time for some cougars. Based on these results we conclude that cougars are facultative scavengers. A propensity to scavenge made cougars susceptible to snaring causing high annual mortality in radiocollared cougars (0.11, 95% CI = 0.03–0.21). Provincial cougar mortality data demonstrate that snaring has increased dramatically as a mortality source in Alberta over the last 2 decades. Mortalities of radiocollared cougars during our study were 100% human caused and the addition of snaring mortality to already high hunting mortality resulted in low annual survival (0.67, 95% CI = 0.53–0.81). Our study is one of the first to identify population-level consequences for nontarget animals killed unintentionally by indiscriminate harvest techniques in a terrestrial ecosystem. Maintaining sustainable cougar harvest where snaring at carrion baits is permitted may require flexible hunting quotas capable of accommodating high cougar snaring mortalities in some years.

Knopff, K.H., A.A. Knopff, A. Kortello and M.S. Boyce. 2010. Cougar Kill Rate and Prey Composition in a Multiprey System. J. Wildl. Manage. 74(7):1435-1447.

Abstract

Assessing the impact of large carnivores on ungulate prey has been challenging in part because even basic components of predation are difficult to measure. For cougars (Puma concolor), limited field data are available concerning fundamental aspects of predation, such as kill rate, or the influence of season, cougar demography, or prey vulnerability on predation, leading to uncertainty over how best to predict or interpret cougar–ungulate dynamics. Global Positioning System (GPS) telemetry used to locate predation events in the field is an efficient way to monitor large numbers of cougars over long periods in all seasons. We applied GPS telemetry techniques combined with occasional snow-tracking to locate 1,509 predation events for 53 marked and an unknown number of unmarked cougars and amassed 9,543 days of continuous predation monitoring for a subset of 42 GPS-collared cougars in west-central Alberta, Canada. Cougars killed ungulates at rates near the upper end of the previously recorded range, and demography substantially influenced annual kill rate in terms of both number of ungulates (subad F [SAF] = 24, subad M [SAM] = 31, ad M = 35, ad F = 42, ad F with kittens <6 months = 47, ad F with kittens >6 months = 67) and kg of prey (SAF = 1,441, SAM = 2,051, ad M = 4,708, ad F = 2,423, ad F with kittens <6 months = 2,794, ad F with kittens >6 months = 4,280). Demography also influenced prey composition; adult females subsisted primarily on deer (Odocoileus spp.), whereas adult males killed more large ungulates (e.g., moose [Alces alces]), and subadults incorporated the highest proportion of nonungulate prey. Predation patterns varied by season and cougars killed ungulates 1.5 times more frequently in summer when juveniles dominated the diet. Higher kill rate in summer appeared to be driven primarily by greater vulnerability of juvenile prey and secondarily by reduced handling time for smaller prey. Moreover, in accordance with predictions of the reproductive vulnerability hypothesis, female ungulates made up a higher proportion of cougar diet in spring just prior to and during the birthing period, whereas the proportion of males increased dramatically in autumn during the rut, supporting the notion that prey vulnerability influences cougar predation. Our results have implications for the impact cougars have on ungulate populations and have application for using cougar harvest to manage ungulates.

Koch, D.B. 1994. Biopolitical Management of Mountain Lions, Tule Elk, and Black Bears in California. Int. Conf. Bear Res. and Manage. 9(1):561-566.

The hunting of mountain lions (Felis concolor), tule elk (Cervus elaphus nannodes), black bears (Ursus americanus), and other mammals has become controversial in California. Litigation by animal protection groups has resulted in several rulings regarding procedures used to adopt hunting regulations. The process has resulted in all hunting regulations being adopted pursuant to the California Environmental Quality Act. Although the process has been expensive and frustrating, and hunting opportunities have been foregone, many benefits in terms of the public's increased awareness of key issues

facing wildlife populations have resulted from the litigation.

Koehler, G.M. and M.G. Hornocker. 1984. Mountain Lions as a Mortality Factor in Bobcats. Pgs. 170-171 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.

Of twenty-seven bobcat radio-collared during the previous three years in this study, eight or 33% have died from natural causes and 5 of the 8 were believed to have been killed by mountain lions. Opportunities for increased interactions and competition between predators occurs on the winter range where major ungulates confine their activities to the lower elevations. The bobcat was killed but not eaten indicating possible defense of its kill or to steal a carcass from a bobcat. Mountain lions appear to be a significant factor in bobcat mortality in this study area on winter range.

Koehler, G.M. and M.G. Hornocker. 1986. A Preliminary Survey of Mountain Lions in Yellowstone National Park. Wildl. Res. Inst., Moscow, Idaho. 12pp.

A systematic survey was conducted to determine the status of the mountain lion on winter range within Yellowstone National Park from 7 January to 1 April 1986. A total of 60 days were spent in the field and 720 km were traveled searching for mountain lions. Tracks were observed on 13 occasions representing possibly 3 to 5 individuals, including at least one male. All observations of mountain lion sign occurred in Douglas fir forest associations at elevations below 2134 m where snow depth was less than 50 cm. Elk were abundant and deer were scarce and elk represented the dominant prey item in the areas occupied by mountain lions. Hunter harvest was greatest along the Yellowstone River north of Yellowstone National Park where 48 mountain lions were harvested from 1981 to 1985 and this area was the most likely source of recolonizing lions.

Koehler, G.M. and M.G. Hornocker. 1991. Seasonal Resource Use Among Mountain Lions, Bobcats, and Coyotes. J. Mammal. 72(2):391-396.

Use of prey, and topographic and habitat features by mountain lions (*Felis concolor*), bobcats (*Lynx rufus*), and coyotes (*Canis latrans*) in central Idaho was investigated to determine how syntopic carnivores coexist where resource use may overlap. There were significant differences in use of elevation, forest types, terrain, overstory density, and exposure by these predators during summer. Despite morphological and behavioral differences permitting these predators to partition resources, resource use overlapped during winter when snow confined prey and predators to lower elevations. Overlap in their diets was significant during winter resulting in mountain lions killing bobcats and coyotes while defending or usurping food caches.

Koehler, G.M. and E. Nelson. 2003. Project Cat (Cougars and Teaching): Integrating Science, Schools and Community in Development Planning. Page 140 *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

Complaint reports of cougars (*Puma concolor*) venturing into urban areas, killing livestock and pets, and threatening humans have increased to more than 1,000 reports filed annually in Washington; where in the past 5 years cougars have mauled 2 children. Increased reports are coupled with human population increases of over 1 million in the past decade and an annual loss to development of over 28,000 ha of land. The rural Cle Elum-Roslyn community is experiencing similar growth and development with >5,000 ha of development and over 1,400 new homes planned, but presently with few complaints of cougars. The winter of 2002-2003 marked the beginning of the 2nd year of an 8-year scientific investigation on cougar and ecology by the Washington Department of Fish and Wildlife and data collection and analysis by teachers and students at Cle Elum-Roslyn School District. To date we have captured and marked with GPS collars 4 adult and 2 subadult male and 4 adult female cougars. GPS transmitter collars collect GPS coordinates at 4-hour intervals throughout the year. This data is plotted onto GIS to assess proximity to human residence, planned development, recreational centers, and to assess predation events and habitat use patterns. This investigation is used to engage students in an experiential learning activity whose focus is application of technology and learning about their ecological and social community. Students in kindergarten to senior high help collect and analyze data. Junior-Senior students in Advanced

Placement Biology assist with cougar capture and marking efforts and correlate location data with GIS habitat, topographic, and human residence parameters. They will use DNA isolated from cougar scats to determine species and gender of animals depositing scats while 8th grade students analyze scats for contents to correlate food habits with gender of cougars. Elementary students learn plant identification for plotting habitat types and learn animal track identification for reporting locations of carnivores and ungulate prey species near their residence. Students count ungulates along bus routes for long-term monitoring of prey distribution in relation to seasons and development. Students and community member conduct tests of GPS collars to assess influences of vegetative and physiographic conditions on satellite acquisition rate and accuracy. Students are assessed on their abilities to collect qualitative and quantitative data. Community members help collect data and help train students in outdoor and data collection skills. Central Washington University incorporates Project CAT objectives into training teachers. Information on ungulate habitat and cougar travel corridors is shared with community planners to incorporate into planning processes to minimize human-cougar interactions.

Koehler, G.M. and B.T. Maletzke. 2005. Movement Patterns of Male and Female Cougars (*Puma concolor*): Implications for Harvest Vulnerability. Page 204 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

Prior to 1996 the use of hounds was permitted to hunt cougars in Washington State and since then and the approval of Voter Initiative I-655 the use of hounds was banned for hunting cougars. Harvest data shows a preponderance of male cougars in the harvest prior to 1996 and a preponderance (~60%) of young-aged females in the harvest after hound hunting was made illegal. Conventional understanding is that hound hunters select for males because hunters have the opportunity to assess the sex and trophy quality of cougars that are treed, which allows hound hunters to select for male cougars. Since hound hunting was banned hunters purchased permits along with other big game permits and harvest of cougars has been either incidental to hunting other species or by using predator calls or stalking cougars in snow. This harvest strategy is considered, by some, to provide hunters with little opportunity to select sex and age of cougars harvested. We analyzed movement data from 22 cougars that were marked with GPS collars and have obtained >16,000 GPS locations in western Kittitas County Washington. Movement data from GPS locations show different travel patterns for male and female cougars. Males, which show greater distance traveled per day and larger home range areas, may be more vulnerable to hound-hunters who drive roads and search large area to search for cougar tracks for hunting. Females, on the other hand, occupy smaller home ranges and use space more intensively and may be more vulnerable to harvest by hunters who search smaller areas more intensively while hunting deer or elk. Differences in home range size and daily movements may account for differences in sex and age of cougars harvested by hunters who use hounds or those who kill cougars incidental to hunting other big game species.

Koford, C.B. 1946. A California Mountain Lion Observed Stalking. J. Mammal. 27:274-275.

On February 7, 1946, the author observed a California mountain lion (F.c. californica) apparently stalking deer at midday. The lion was spotted at 12:40 P.M. in the open about 300 yards downhill from nine deer grazing near the summit of Whiteacre Peak, Ventura County, California. The sequence of events is recounted. The maximum count of steps between stops was 19 going uphill and 29 downhill. According to the author, the most interesting feature of the actions of the lion was the erect pose when sitting, presumably to keep the deer in view over the intervening ridges.

Koford, C.B. 1977. Status and Welfare of the Puma (Felis concolor) in California, 1973-1976. Final Report to the Defenders of Wildlife and the National Audubon Society, Univ. of Ca., Berkeley. 57pp.

SUMMARY

From 1973-1976, I investigated the distribution and welfare of the puma in California by means of analyzing records, perusing literature, interviewing, inspecting habitats, and ground tracking cats. Pumas now occur over most of the region they occupied half a century ago but they regularly live only in limited patches of widespread habitat types, mainly mixed conifers and mixed brushlands in mountains. Bounty records for 55 years before 1963 indicate that the rate of kill fell

notably during the 1940s, that the region of greatest kill shifted from northwestern to south central mountains, that in patches where the kill-rate had been low the cats became rare, and that in patches where the kill-rate had been moderate to high the portion occupied by pumas shrank. Reductions since 1950 were largely caused by loss of habitat through increase in mountain roads and reservoirs, with concomitant human use, and this loss continues. The main prey of the puma, deer, have declined greatly since the mid 1960s. Yet, in some localities pumas have become more conspicuous during five years of hunting moratorium. Judged by the results of 3000 miles of slow tracking on roads and trails mostly in six study areas, the average summer densities per 100 square miles in favorable habitat are about 3 grown pumas. Bounty and recent reports show that the cats reside year around and produce young in a total area of perhaps 15,000 square miles, mostly in the northwestern mountains, the southern Coast Range, and the western slope of the southern Sierra Nevada. Additional pumas, mostly young males and other non-breeders, are more mobile and occur sporadically over a larger area. The number in the state changes with season and year, depending on varying rates of birth and survival in many subpopulations, and production rates are conjectural. As a working estimate of total numbers, however, I suggest an average of 1000, of which roughly 300 females are of breeding age. Numbers are apparently limited by interactions among the pumas rather than by fluctuating prey abundance, and are regulated through mortality and dispersal of young. Pumas in California survived decades of hunting, mostly during a period of rapid increase of deer and people, but they may not thrive in an increasingly modified environment. Reports of kittens are rare and in many subpopulations, especially in far southern counties, replacement of breeding females may be inadequate to sustain moderate numbers. To provide the maximal scientific, ecological, and esthetic values of our most spectacular carnivore, the basic management of the puma in California should be protection in a naturalistic setting.

Koford, C.B. 1978. The Welfare of the Puma in California, 1976. Carnivore 1(1):92-96.

California was the only state where the puma was protected by a hunting moratorium. Classed as a big game animal in 1969, public demand brought about protection in 1972. Over 12,000 bounties were paid on the puma between 1908-1963. The trend had been toward disappearance of puma kills from previously low bounty kill rate zones and into parts of earlier moderate-to-high bounty kill rate zones, as might be expected in a decreasing overall population. Average bounty kill dropped from about 290 during the first 8 years to about 135 during the last 8 years. The author concluded that the overall range of regular occurrence of puma in California had been relatively stable for decades and comprised roughly 15,000 square miles. There appeared to be no evidence of expansion of resident range in California during this century. It was concluded that the average summer density in good puma country throughout California is 3 grown cats per 100 square miles and that there were less than 1000 pumas in California.

Kohls, R. 1988. Mountain Lion Law Enforcement Problems in Arizona. Pg. 42 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.

Regulations governing the taking of mountain lions (Felis concolor) in Arizona have recently undergone some significant changes. As regulations become more restrictive it is expected that the unlawful taking of mountain lions will also increase. Seven problem areas of enforcing mountain lion regulation are: taking lions without a permit; unlawful taking of lions by trappers; "will-call" hunting; taking of lions at night; use of vehicles as aids in hunting lions; take of lions under the guise of livestock depredation; and the use of lion permits to "Buddy Hunt" for other big game. All problem areas need to be considered when proposing new regulations concerning the harvesting or protection of Arizona's mountain lions.

Koloski, J.H. and F.G. Lindzey. 2003. Mountain Lion Home Range Use in a Fragmented Landscape. Page 64 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

Coal-bed methane development and associated roading has led to habitat fragmentation on the western portion of the Southern Ute Indian Reservation in southwest Colorado. A moratorium on gas development is in place on the eastern portion of the reservation however, and habitats remain relatively intact. Fourteen mountain lions (Puma concolor) were captured and equipped with radio transmitters across the reservation between January 1999 and July 2000. We estimated home ranges (95% utilization distributions) and core use areas (50% utilization distributions) for 6 female mountain lions using the eastern portion of the reservation and for 5 mountain lions (3 M, 2 F) using the western portion. We compared

indices of habitat fragmentation between the east and west portions of the reservation and between mountain lion home ranges and core areas within their respective portions of the reservation. Patch size and patch perimeter were larger (P = 0.001) in the east (0.047km^2 and 1.00km, respectively) than the west (0.035 km^2 and 0.84km, respectively). Patch density, edge density, and road density were higher in the west (28.3 patches/km^2 vs. 21.5 patches/km^2, 23.8 km/km^2 vs. 21.93 km/km^2, 2.54 km/km^2 vs. 1.88 km/km^2, respectively). Within mountain lion home ranges and core areas, patch size, patch perimeter, patch density, edge density, and road density did not differ from values for the east and west portions encompassing them. These results suggest that mountain lions are not selecting home ranges or core areas based of levels of habitat fragmentation on the Southern Ute Indian Reservation.

Korpos, M. 2003. Critical Cougar Crossing and Bay Area Regional Planning. Page 172 *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 goal of this presentation is to illustrate the need for habitat conservation and regional planning on behalf of cougars (*Puma concolor*), which play an integral role in the health of their ecosystems. As a keystone species, "further degradation of [cougar] habitat connectivity will lead to cascading impacts down through successively lower trophic levels…" (Jigour 2000). County borders are human constructs with no ecological relevance. It can be assumed certain cougar home ranges overlap San Mateo, Santa Clara and Santa Cruz Counties (California), while others may overlap Monterey, San Benito and Santa Cruz Counties. These counties contain the Santa Cruz Mountains, and the Gabilan and Diablo Mountain Ranges. The challenge is to maintain land connections between large patches of intact habitat through open communication among county agencies and through regional planning efforts. By developing land on a project-by-project basis, counties promote habitat fragmentation. Left unchecked, human development in and around the Santa Cruz Mountains will continue to fragment cougar habitat, leading to geographic isolation, and the eventual demise of our local population. Maintaining large tracts of land and providing connections through less hospitable landscapes are critical to ensuring the future health of cougar populations and the wildlife that share their ecosystems.

Kortello, A. and D.L. Murray. 2005. Interactions Between Wolves (*Canis lupus*) and Cougars (*Puma concolor*) in the Bow Valley, Banff National Park, Alberta. Page 175 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

Interactions between individuals, populations, and species help maintain the structure and function of ecosystems. This is particularly true in the case of predators at the top of the food chain (Soule et al, 2003). Few places in North America retain their historical large predator community; hence research on interactions among large carnivores is sparse but relevant from the perspective of wildlife management and conservation. In the present study on wolves *(Canis lupus)* and cougars *(Puma concolor)* in Banff National Park, AB, we found indication that direct and indirect interactions between carnivore species helped shape community dynamics. Clearly, prey switching by cougars in response to wolf-induced declines in primary prey, elk, supported the contention that exploitative interactions occurred between the two species with wolves being the dominant competitor. Wolves also appeared to be dominant with respect to interference interactions, including direct predation of cougars and usurpation of prey killed by cougars. Avoidance is a possible response to such interactions and cougar home ranges exhibited limited overlap with areas occupied by wolves. Although dynamic interaction analysis on radioed individuals of both species failed to show non-random distribution of predators across the landscape, we found that cougars temporally avoided areas occupied by wolves. At the finest scale of analysis, at intersections of wolf and cougar tracks, non-random space use was consistent with asymmetrical avoidance behaviour by cougars. The effects of these interactions on prey populations, cougar space use, and cougar population dynamics likely has broader implications to wildlife management and conservation efforts in areas where wolf populations are expanding.

Kortello, A.D., T.E. Hurd and D.L. Murray. 2007. Interactions Between Cougars (*Puma concolor*) and Gray Wolves (*Canis lupus*) in Banff National Park, Alberta. Ecoscience 14(2):214-222.

Abstract

Large carnivore populations are recovering in many protected areas in North America, but the effect of increasing carnivore

numbers on existing predator-prey and predator-predator interactions is poorly understood. We studied diet and spatial overlap among cougars (*Puma concolor*) and gray wolves (*Canis lupus*) in Banff National Park, Alberta (1993-2004) to evaluate how wolf recovery in the park influenced diet choice and space use patterns of resident cougars. Cougars (n = 13) and wolves (n = 8 in 2 packs) were monitored intensively over 3 winters (2000-2001 to 2002-2003) via radio telemetry and snowtracking. We documented a 65% decline in the local elk population following the arrival of wolves, with cougars concurrently switching from a winter diet primarily constituted of elk to one consisting mainly of deer and other alternative prey. Elk also became less important in wolf diet, but this latter diet switch lagged 1 y behind that of cougars. Wolves were responsible for cougar mortality and usurping prey carcasses from cougars, but cougars failed to exhibit reciprocal behaviour. Cougar and wolf home ranges overlapped, but cougars showed temporal avoidance of areas recently occupied by wolves. We conclude that wolves can alter the diet and space use patterns of sympatric large carnivores through interference and exploitative interactions. Understanding these relationships is important for the effective conservation and management of large mammals in protected areas where carnivore populations are recovering.

Krumm, C.E., D.O. Hunter and M.W. Miller. 2005. Mountain Lion Research in Northeastern Colorado – Testing New GPS (Global Positioning Systems) Technology. Page 226 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

An interagency collaboration has been established in northeastern Colorado to coordinate and integrate ongoing mountain lion *(Puma concolor)* research. Two main areas of study are underway. One focus is on the role of mountain lions in chronic wasting disease (CWD) ecology. Surveys conducted since 1996 have provided data on CWD prevalence in mule deer *(Odocoileus hemionus)* and the potential effects of selective population control on infection rates. Our current study tests the hypothesis that mountain lions prey selectively on mule deer infected with CWD. The other focus of study is on developing techniques for capturing and monitoring mountain lions in national parks. This study aims to learn more about the general ecology of the mountain lion in and around Rocky Mountain National Park. We are conducting research to better understand the value and appropriateness of new tools and techniques for mountain lion capture and monitoring. GPS-collared mountain lions from the prey selection study will aid in assessing the effectiveness of non-invasive techniques. In conjunction with this work, we are evaluating new technology in Global Positioning Systems (GPS) tracking of animals (Lotek Wireless, Newmarket, Ontario and H.A.B.I.T. Research, Victoria, British Columbia) that allows location data to be downloaded remotely without retrieval of collars either from the field or via ARGOS satellite transmission. The time expenditure to field-test new innovations in GPS technology often becomes a trade-off with what is gained by increasing ease in obtaining data. A cost analysis, both with money and field time, allows researchers to see the benefits of testing and evaluating technology as it progresses.

Kunkel, K.E., T.K. Ruth, D.H. Pletscher and M.G. Hornocker. 1999. Winter Prey Selection by Wolves and Cougars in and Near Glacier National Park, Montana. J. Wildl. Manage. 63:901-910.

Abstract

Expansion by wolf (*Canis lupus*) populations in the western United States creates new opportunities and challenges for researching and managing large mammal predator-prey systems. Therefore, we compared patterns of prey selection between wolves and cougars (*Puma concolor*) to ascertain the effects of multiple predators on prey and on each other. Because of differences in hunting techniques, we predicted that wolves would kill more vulnerable classes of prey than cougars. Our results did not support this prediction. White-tailed deer (*Odocoileus virginianus*) composed the greatest proportion of wolf (0.83) and cougar kills (0.87), but elk (*Cervus elaphus*) and moose (*Alces alces*) composed a larger proportion of wolf (0.14, 0.03, respectively) than cougar (0.06, 0.02, respectively) kills. Wolves and cougars selected older and younger deer and elk than did hunters. Cougars killed relatively more bull elk (0.74) than did wolves (0.48). Male deer killed by cougars had shorter diastema lengths than did male deer killed by wolves (P = 0.02). Pack hunting by wolves and dense stalking cover may have partially explained the failure to support predictions of the coursing versus stalking dichotomy. Wolves and cougars may be exhibiting exploitation and interference competition that is affecting each others' behavior and dynamics, and that of their prey.

Kunkel, K., D.H. Pletscher and T.K. Ruth. 2003. Mountain Lion Home Range Use in a Fragmented Landscape. Page 64 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

To assess impacts of wolf (Canis lupus) recolonization on prey and other predators, we examined factors affecting hunting success of cougars (Puma concolor) and wolves in a multi-prey system in northwestern Montana. Cougars killed white-tailed deer (Odocoileus virginianus) at sites with greater slope, more mature trees, and greater canopy coverage than were present at sites where wolves killed deer. Cougar kill sites were closer to water than were wolf kill sites. Cougar kill sites had lower densities of deer and were further from deer trails than were control sites. Compared to control sites, more deer were killed by wolves at flatter sites and at sites with lower densities of deer. Antipredator strategies used by deer to avoid wolves may not be as successful for avoiding cougars and vice versa. Managers interested in reducing vulnerability of deer to wolf and cougar predation should consider maximizing deer density in a few large wintering areas and thinning stalking cover while maintaining browse species in those areas.

Kurta, A., M.K. Schwartz and C.R. Anderson Jr. 2007. Does a Population of Cougars Exist in Michigan? American Midland Naturalist 158(2):467-471.

Abstract

After analyzing DNA obtained from fecal samples gathered in Michigan, Swanson and Rusz (2006) claimed that 83% of identified scats were from cougars, indicating to them that a population of these large carnivores existed in the state. In this paper, we identify problems with their methodology, suggest that they unreasonably extrapolated their conclusions and point out that their results are improbable, especially in light of no other evidence in the scientific literature suggesting the existence of a population of cougars in Michigan.

Kurten, B. 1976. Fossil Puma (Mammalia:Felidae) in North America. Neth. J. Zool. 26(4):502-534.

SUMMARY

Fossil finds of Felis (Puma) from North America are listed and described. They range in time from the late Blancan to the sub-Recent. Blancan and Irvingtonian material is referred to F. inexpectata, Rancholabrean and later to F. concolor. The extinct F. inexpectata differs from F. concolor in its larger size and different dental and limb proportions and probably was adapted to a more cursorial mode of predation. Sparse fossil remains of a still older, smaller form may represent the ancestry of F. inexpectata and a relationship to certain Old World felids, especially "Panthera" schaubi, is possible. Evidence of a transition in Irvingtonian-Rancholabrean times may suggest that F. inexpectata was ancestral to the living pumas. Rancholabrean pumas show north-south clines in size analogous to that in the Recent population.

Kurushima, J.D., J.A. Collins, J.A. Well and H.B. Ernest. 2006. Development of 21 Microsatellite Loci for Puma (*Puma concolor*) Ecology and Forensics. Molecular Ecology Notes 6(4):1260-1262.

Abstract

We developed 21 microsatellite (13 dinucleotide and 8 tetranucleotide) primers specifically for pumas (*Puma concolor*). The primers were tested across 243 individuals from California and Nevada, and displayed an average of 5.5 alleles per locus. Previously, domestic cat (*Felis catus*) primers have been adapted for puma genetic studies. Puma-specific loci may reduce concerns associated with ascertainment bias, improve genetic structure resolution and provide additional tetranucleotide loci valuable for forensic applications. These puma-specific microsatellites will aid studies involving parentage, kinship and population structure, along with forensic case applications including poaching and puma-associated injuries to humans and domestic animals.

Kutilek, M.J., R.A. Hopkins, E.W. Clinite, and T.E. Smith. 1983. Monitoring Population Trends of Large Carnivores Using Track Transects. Pgs. 104-106 In: Renewable Resources Inventories for Monitoring Changes and Trends; Proc. of an

International Conf., J.F. Bell and T. Atterbury (eds.). Corvallis, Oregon.

There is a need to develop reliable, inexpensive ways to monitor population trends for large carnivores. During the summers of 1980 and 1981, we systematically searched for mountain lion tracks along dirt roads in five areas of California to assess the use of track transects as a population trend indicator. The number of sets of tracks for the five areas ranged from 0.6 to 3.7 lions per 100 km of road tracked. For areas of limited size, two 32-40 km-long transects repeated over five consecutive days were reasonably consistent in the number of track sets found from one year to the next. For trends over large areas (e.g. statewide) we suggest using numerous annual, one-day transects with a simplified system of data collection and analysis. Caution must be used in comparing data from one area to another due to differences in topography and vegetation and their effect on road use by carnivores.

Kuyava, G.C. 1959. Two Reports of Mountain Lion from Lake and Cook Counties. Flicker 31(1):6.

Previous to 1958, there were only five records of the puma in the state of Minnesota. The author describes three reports of cougar sightings in Lake and Cook Counties, Minnesota. Previous records of the puma were from Lyon, Becker, Ottertail, and Chisago Counties, Minnesota.

Kuyt, E. 1971. Possible Occurrence of Cougar Near Fort Smith, N.W.T. Blue Jay 29:142-143.

Two cougars were reportedly observed about 5 miles south of the Parson's Lake fire lookout tower in the northern part of Wood Buffalo National Park at approximately 59^{o} 50'N, 112^{o}25'W. Another cougar was sighted on March 17, 1967 on the edge of the road about 12 miles north of Hay Camp, Wood Buffalo National Park. Another cougar was sighted in the summer of 1962 at the foot of Axe Handle Hill in Fort Smith.

Laing, S.P. 1988. Cougar Habitat Selection and Spatial Use Patterns in Southern Utah. M.S. Thesis, Univ. of Wyoming, Laramie. 68pp.

Fifty-two cougars (Felis concolor) were monitored using radio-telemetry between 1979 and 1987 in southern Utah. Tracking cougars with hounds and snow-tracking indicated that their habitat use while active (primarily nocturnal) was essentially the same as when inactive (primarily diurnal radio-locations). Cougars selected pinyon-juniper woodlands with lava boulders disrupting the understory, ponderosa pine/oakbrush, mixed aspen/spruce fir, and spruce-fir habitats. They avoided sagebrush bottomlands, agricultural and pasture lands, pinyon-juniper/ponderosa pine/sagebrush mixtures, slickrock sandstone canyons, and open meadows. A habitat model derived from discriminant function analysis indicated that overstory cover (mean = 56.6%), overstory height (mean = 8.9 m), and slope (mean = 40.0%) were the most important structural characteristics in highly used habitats. Cougar densities in the core study area averaged 1.19/100 km^2 from 1979 to 1987, monitoring an average of 19 individuals per year. Home range sizes of resident cougars averaged 731 km^2 for males (N=6) and 541 km^2 for females (N=18) using convex polygons, and 1,385 km^2 and 664 km^2 respectively, using probability ellipses. Female home range replacement was characterized by the establishment of resident progeny and/or adjacent residents in vacant ranges. Replacement usually involved 2 or more individuals sharing the range of the original resident female, while expanding into adjacent areas. Numbers of resident males was generally <2 per year prior to 1986, after which the density of male residents increased to 6, although the number of resident females remained stable throughout the study.

Laing, S.P. and F.G. Lindzey. 1991. Cougar Habitat Selection in South-central Utah. Pgs. 27-37 In: Mountain Lion-Human Interaction Symposium, C.E. Braun (ed.), Col. Div. Wildl., Denver. 114pp.

Fifty-two cougars (Felis concolor) were monitored by radiotelemetry during 1979-1987 in south-central Utah. Tracking cougars with hounds and by snow-tracking during 1986-1987 indicated essentially the same habitat use while active (primarily nocturnal) as diurnal radiolocations. Cougars used pinyon-juniper woodlands with lava boulders disrupting the understory, ponderosa pine/oakbrush, mixed aspen/spruce-fir, and spruce-fir habitat types more than availability suggested. A habitat model derived from discriminant analysis revealed that slope and overstory cover and height were the most indicative characteristics of highly used habitats.

Laing, S.P., and F.G. Lindzey. 1993. Patterns of Replacement of Resident Cougars in Southern Utah. J. Mammal. 74(4):1056-1058.

Members of a cougar (Felis concolor) population in southern Utah were monitored from 1979 through 1987. Vacated ranges of resident females commonly were filled by their independent-aged daughters or those of adjacent resident females. Less often, immigrating, transient females established residency in these vacated ranges. Adjacent resident females did not significantly shift nor expand their ranges into neighboring vacated ranges. Vacated ranges of resident males were filled by immigrating, transient males.

Lambert, C.M.S. 2003. Dynamics and Viability of a Cougar Population in the Pacific Northwest. M.S. Thesis. Washington State Univ., Dept Nat. Resources.

Abstract

Cougar (*Puma concolor*) populations are believed to be at high density and increasing throughout western North America, especially in the Pacific Northwest, as evidenced by increasing cougars/humans encounters. Harvest rates have increased as a result. To test this hypothesis, I determined the density, fecundity, survival, and growth rate of a cougar population in northeastern Washington, northwestern Idaho, and southern British Columbia. From 1998 to 2003, 52 cougars were captured, radio-collared, and monitored. I recorded fecundity through den site investigation and snow tracking, and mortality by weekly telemetry. Survival rates were estimated for kittens (0-1 yr), yearlings (1-2 yr), and adult (2-12 yr) males and females. Average overall density was 1.09 cougars/100km^2 or 0.46 adults/100km^2. I estimated the litter size at 2.53 kittens, the birth interval at 18 months, the proportion of reproductively successful females at 0.75, and the age of first reproduction at 30 months, for a maternity rate of 0.63 male or female kitten/year/adult female. Average survival rate for all radio-collared cougars was 0.59, 0.77 for adult females, 0.44 for adult males, 0.37 for yearlings, and 0.57 for kittens. Hunting accounted for 92% of the mortalities of radio-collared cougars. Age- and sex-specific survival and fecundity were entered into a stochastic two-sex matrix model. I used computer simulations to determine the stochastic growth rate of the population and to assess its viability over 25 years. The annual stochastic growth rate of this population was $\lambda = 0.80$ (95%CI = 0.11). Starting with a total initial abundance of 357, the median times to fall below a demographic collapse (N = 30 adults) and extirpation (N = 0) were 8.5 and 25.9 years. My findings suggest that, contrary to popular belief, cougars in the Pacific Northwest are currently at low to moderate densities and are declining. Alternative hypotheses may account for the increased conflicts between cougars and humans in this area.

Lambert, C., R.B. Wielgus, H.S. Robinson, D.D. Katnik, H. Cruickshank and R. Clarke. 2003. Dynamics and Viability of a Cougar Population in the Pacific Northwest. Page 139 *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*) populations are believed to be at high density and increasing throughout western North America, especially in the Pacific Northwest, as evidenced by increasing cougars/humans encounters. Harvest rates have increased as a result. To test this hypothesis, we determined the density, fecundity, survival, and growth rate of a cougar population in northeastern Washington, northwestern Idaho, and southern British Columbia. From 1998 to 2003, 52 cougars were captured, radio-collared, and monitored. We recorded fecundity through den site investigation and snow tracking, and mortality by weekly telemetry. Survival rates were estimated for kittens (0-1 yr), yearlings (1-2 yr), and adult (2-12 yr) males and females. Average overall density was 1.09 cougars/100km^2 or 0.46 adults/100km^2. We estimated litter size at 2.53 kittens, birth interval at 18 months, proportion of reproductively successful females at 0.75, and age of first reproduction at 30 months, for a maternity rate of 0.63 male or female kitten/year/adult female. Average survival rate for all radio-collared cougars was 0.59, 0.77 for adult females, 0.44 for adult males, 0.37 for yearlings, and 0.57 for kittens. Hunting accounted for 92% of the mortalities of radio-collared cougars. Age- and sex-specific survival and fecundity were entered into a stochastic two-sex matrix model. We used computer simulations to determine the population stochastic growth rate and to assess its viability over 25 years. The annual stochastic growth rate of this population was $\lambda = 0.80$ (95%CI = 0.11). Starting with a total initial abundance of 357, the median times to fall below a demographic collapse (*N* = 30 adults) and extirpation (*N* = 0) were 8.5 and 25.9 years. Our findings suggest that, contrary to popular belief, cougars in the Pacific Northwest are currently at low to moderate densities and are declining. Alternative hypotheses may account for

the increased conflicts between cougars and humans in this area.

Lambert, C.M.S., R.B. Wielgus, H.S. Robinson, D.D. Katnik, H.S. Cruickshank, R. Clarke and J. Almack. 2006. Cougar Population Dynamics and Viability in the Pacific Northwest. J. Wildl. Manage. 70(1):246-254.

Abstract

Increasing reports of human/cougar conflicts may suggest that cougars are increasing in the Pacific Northwest. We determined minimum relative densities and average fecundity, survival, and growth rate of an apparently increasing cougar population in northeastern Washington, USA; northern Idaho, USA; and southern British Columbia, Canada, from 1998 to 2003. Minimum relative densities declined from 1.47 cougars/100 km^2 to 0.85 cougars/100 km^2. We estimated average litter size at 2.53 kittens, interbirth interval at 18 months, proportion of reproductively successful females at 75%, and age at first parturition at 18 months for a maternity rate of 1.27 kittens/adult female/yr. Average survival rate for all radiocollared cougars was 59%: 77% for adult females, 33% for adult males, 34% for yearlings, and 57% for kittens. Hunting accounted for 92% of mortalities of radiocollared cougars. The annual stochastic growth rate of this population was $\lambda = 0.80$ (95% CI = 0.11). Contrary to accepted belief, our findings suggest that cougars in the Pacific Northwest are currently declining. Increased conflicts between cougars and humans in this area could be the result of the 1) very young age structure of the population caused by heavy hunting, 2) increased human intrusion into cougar habitat, 3) low level of social acceptance of cougars in the area, or 4) habituation of cougars to humans. To help preserve this population, we recommend reduced levels of exploitation, particularly for adult females, continuous monitoring, and collaborative efforts of managers from adjacent states and provinces.

Lambert, H. 1955. There Ain't No "Painters" in West Virginia. West Virginia Conservation. March, pp. 11-12.

The last evidence of panthers in West Virginia was tracks found in 1936 in Pocahontas County. Hundreds of panthers have been reported since that time, but no real evidence had been presented. In the late 1800's, panther numbers dwindled with decreasing deer numbers. The panther was still considered extinct in West Virginia.

Lamm, M.G., M.E. Roelke, E.C. Greiner and C.K. Steible. 1997. Microfilariae in the Free-ranging Florida Panther (*Felis concolor coryi*). J. Helminthological Society of Washington 64:137–141.

Abstract

Blood samples from Florida panthers (*Felis concolor coryi*) collected from 1986 to 1993 during the months of December through May were screened for the presence of microfilariae (mff) by the Difil® filter test. Thirty-five of 47 (74.5%) panthers older than 2 yr of age were positive with microfilaremias ranging from 10 to 7,380 mff/ml of whole blood. No panthers that were 6 mo of age or less (*n* = 10) were microfilariae-positive, and only 20% of the panthers in the 1-yr class (*n* = 5) were positive. A representative number of microfilariae (*n* = 40) from each of 7 freshly collected positive blood samples was measured and morphological characteristics were noted. The average length of microfilariae processed by the modified Knott's technique was 320 µm. The finding of no significant difference ($P > 0.05$) between length measurements due to differences in head and tail shape leads us to believe that all microfilariae were of 1 species. Based on microfilarial length measurements, review of necropsy reports, and comparison with bobcat microfilariae, the most likely filarial species infecting the Florida panther is *Dirofilaria striata* (Molin, 1858).

Land, E.D. 1991. Big Cypress Deer/Panther Relationships: Deer Mortality. Final Report. Study No. 7509, Fed. No. E-l II-E-5b. Florida Game and Fresh Water Fish Commission. Tallahassee. 30pp.

Sixty-six white-tailed deer (Odocoileus virginianus) were captured in the Bear Island Unit of the Big Cypress National Preserve, 57 of which were radio-instrumented. Of the 26 marked deer that died, 10 were taken by bobcats (Felis rufus), 4 by Florida panthers (Felis concolor coryi), and 1 by an alligator (Alligator mississippiensis). Four died of other natural causes, 5 were harvested (3 legally, 2 illegally), and 2 died of unknown causes. Average doe home range size was 239 ha and 2 bucks ranged from 454-1560 ha. There were no differences in survival rates among three intervals: summer (1 May - 31 August), fall/hunting season (1 September - 31 December), and spring (1 January - 30 April). The average annual survival rate was 0.813 (95% CI - 0.68, 0.94), and 64% of the annual mortality was attributable to predation. A

neonate mortality rate of 37.8% plus or minus 16.1 can be inferred by examining pregnancy rates and number of fetuses from collected does and comparing to the fawn-rearing rate from observations of radio-instrumented does. Fawn mortality appeared to fluctuate with surface water levels (high water= high fawn mortality). Hunting activities had little to no impact on does, either in number of illegal kills (2) or by causing does to leave the Preserve (0). The population appeared to be stable with a net reproductive rate (R_0) of 0.97.

Land, E.D. 1994. Response of the Wild Florida Panther Population to Removals for Captive Breeding. Final Report, Study 7571, Fed. # E-1 II-E-2. Florida Game and Fresh Water Fish Commission, Tallahassee. 11pp.

Abstract

Telemetry data were gathered from 24 radio-collared Florida panthers (*Felis concolor coryi*) in southwest Florida during the reporting period. Mortalities of instrumented panthers during this period included 3 males and 1 female, but only the female was considered to be a resident cat. An uncollared dependent kitten of #52 was killed on C.R. 858 north of Hendry Prison. A malfunctioning transmitter and a cat slipping its collar reduced the number of monitored panthers to 18 by the end of June 1994. Six females denned during the past year; eight neonate panther kittens (5 female, 3 male) were handled, tattooed and examined at their dens. Based on observations of litter sizes and fates of radio-instrumented panther kittens, a survival rate of 0.895 can be inferred for the first year of their life. No panther kittens have been removed to captivity since August 1992. All known resident adult home ranges remained occupied. There have been no adverse impacts to the panther population caused by the removals of 10 kittens during 1991-92.

Land, E.D. 1994. Florida Panther Population Dynamics in Southwest Florida. In: Dennis Jordan, ed., Proc. of the Florida Panther Conf., USFWS. 5pp.

The author describes how panthers are captured and provides insights into what has been learned about them in the previous 15 years of study. Over 20,000 radio locations on 56 panthers have been collected since 1981. About 90% of the panther's diet consists of feral hogs, white-tailed deer, raccoon and armadillo with rabbit occasionally taken. Panthers killing panthers, primarily adult males killing juvenile males, is the number one cause of death among radio collared panthers. Road kills account for approximately 20% of known mortality, but all natural causes far exceed the road kill mortality of panthers. Overall, most adult females are producing kittens every other year primarily in the late spring and early summer. The author saw many similarities between statistics in an unhunted cougar population in Utah and panthers in Florida. However, male dispersal distances in Florida are approximately half of the Utah population due to a very limited habitat base which limits the sharing of genetic material in Florida panther populations.

Land, E.D. 1994. Panther Use of the Southern Florida Landscape. In: Dennis Jordan, ed., Proc. of the Florida Panther Conf., USFWS. 4pp.

Pine palmetto communities and hardwood hammocks seem to be the preferred habitats for Florida panthers. Most of the areas occupied by panthers are mosaics, where you have open marshes, cypress domes, hardwood hammocks, and pine palmetto. Young sub-adult males are responsible for most of the use of fringe areas as they wander in search of a place to establish a territory. Females and dominant adult males tend to stay near core areas. Most reproduction occurs along a narrow corridor north of Alligator Alley stretching from the panther refuge out through the addition lands. Eighty to 90% of all panther dens occur in this narrow stretch along I-75. This area is typified by vast areas predominated by native vegetation. The challenge is to try to manage these peripheral areas where the young males are dispersing so they have safe havens that allow them to mature and better compete for prime panther areas. This would allow better gene flow which is necessary to maintain a healthy population.

Land, D. and M. Lotz. 1995. Wildlife Crossing Designs and Use by Florida Panthers and Other Wildlife in Southwest Florida. Fl. Game and Fresh Water Fish Commission, Naples, FL.

Summary

Both designs of wildlife crossings have been used by Florida panthers and a host of other animal species. The I-75 wildlife crossings with their openness and creation of early successional habitat may have encouraged use by white-tailed deer.

The more shaded, cooler, and damper SR 29 structures may have created ideal habitat for raccoon prey items accounting for the heavy use by these mammals. Because both designs were used by a variety of wildlife species, including Florida panthers, we feel that the design is of less importance than their location. It appears that either wildlife crossing design will be successful when placed at sites where animals habitually cross.

Land, E.D., D.R. Garman and G.A. Holt. 1998. Monitoring Female Florida Panthers Via Cellular Telephone. Wildl. Soc. Bull. 26(1):29-31.

A method to transmit signals from denning radio-collared female panthers via cellular phone to efficiently detect opportunities for handling neonate kittens is described.

Land, E.D., S.K. Taylor and M. Lotz. 1998. Florida Panther Genetic Restoration and Management (7508). Annual Rep., Bur. Wildl. Diversity Cons., Florida Game and Fresh Water Fish Commission, Naples. 50pp.

Telemetry data were collected on 31 radio-collared Florida panthers (Puma concolor coryi) and 7 Texas cougars (P. c. stanleyana) in south Florida during the reporting period. Two instrumented panthers died (ruptured aorta, intraspecific aggression), and 1 Texas cougar was illegally shot and killed during the study period. One uncollared female panther died from a collision with a vehicle and an older captive panther was euthanized due to declining health. Eight new panthers were added to our radiocollared population this past capture season. Comparing reproduction among panthers and cougars, two female panthers denned during the past year producing 4 neonate kittens (2_, 2_) and two female Texas cougars denned producing 3 neonate kittens (1_, 2_). All were marked with transponders. A total of 12 (4_, 8_) F1 kittens have been produced and none of these kittens have exhibited kinked tails or cowlicks. Over the same time period, 24 kittens were born to panthers and 19 had kinked tails. Three panthers were held in captivity for several months this reporting period. Male panther #51, previously held to treat a mycotic dermatitis, was treated for a broken toe and to diagnose and remove a large mass from his hip. Female panther #61(F1) was placed in captivity after she was found to be suffering from severe anemia and dehydration in June 1997. She was released back into her former territory after 55 days in captivity and has resumed normal movements. Female panther #69, a 10-month-old dependent kitten, was captured in an emaciated and dehydrated state following the death of her mother. She was taken to White Oak Conservation Center for maturation in preparation for release back into the wild.

Land, D., M. Cunningham, M. Lotz, and D. Shindle. 2002. Florida Panther Genetic Restoration and Management, July 2001–June 2002. Unpublished Report. Bureau of Wildlife Diversity Conservation, Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida, USA.

Abstract

Telemetry data were collected on 42 radiocollared Florida panthers (*Puma concolor coryi*) and 3 Texas cougars (*P. c. stanleyana*) in southern Florida during the reporting period. Five radiocollared panthers and 3 uncollared panthers died this past year. Male panthers FP96 and FP97 and female panther FP49 died of intraspecific aggression; male panther FP92 and female panther FP105 died of unknown causes. The three uncollared panthers were struck and killed by vehicles. Six new panthers were added to our radiocollared population this past capture season. Our current verifiable population count is 80 adult and subadult panthers and does not include kittens at dens. We documented 14 panther dens during the study period producing a total of 30 neonate kittens (13F, 17M). No Texas puma produced litters during the study period. All of these kittens were handled successfully at their dens, permanently marked with subcutaneous transponder chips, and skin biopsies taken. We have radiocollared a total of 112 panthers since 1981 and handled 136 neonate kittens at dens since 1992. Apparently, genetic introgression is reducing the occurrence of kinked tails, cowlicks, and cryptorchidism. Preliminary analysis indicate that the likely representation of Texas puma genes is on target with the originally proposed introgression level of 20%.

Land, E.D., O.L. Bass, D.K. Jansen, R.T. McBride and D. Shindle. 2003. Florida Panther Genetic Restoration: A Status Report. Page 65 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

An estimated 60-70 Florida panthers (Puma concolor coryi) exist currently in the wild in Florida, following a population increase over the past decade. The panther's distribution in the state remains largely south of the Caloosahatchee River, but panthers range north nearly to Orlando. Most effort in panther management is presently directed toward genetic restoration, specifically monitoring the pedigree, molecular, and physical effects of purposefully releasing 8 young female pumas from Texas into the core range of the Florida panther in 1995. This release was intended to infuse Texas puma (P. c. stanleyana) genetic material into the Florida panther population to correct physical abnormalities attributable to low genetic diversity. Our stated goal was to have each Texas female produce at least 2 recruited offspring and this level of genetic infusion was expected to augment the panther population genetic make-up over time such that 20% of its diversity could be traced back to Texas puma genes. Five of the 8 Texas females bred, producing 18 known offspring. First generation offspring have now produced at least 18 second-generation offspring of their own and 25 of these 36 descendants are thought to be alive today. Preliminary pedigree analysis suggests that we have achieved our genetic goal, but additional monitoring will be necessary to determine if desired physical improvements are achieved.

Land, E.D., J.W. Kasbohm and D. Jennings. 2003. Recovery of the Florida Panther: Accomplishments and Future Needs. Pages 65-66 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

Florida panthers (Puma concolor coryi) ranged historically from Louisiana and Arkansas eastward into South Carolina and southward through Florida. Currently, 60-70 panthers exist in the wild in southern Florida. The panther was listed as an endangered species by the Department of the Interior in 1967 and a recovery plan was first developed in 1981 followed by 2 revisions in 1987 and 1995. All versions share the objective of achieving 3 viable, self-sustaining populations within the historic range. Steps to achieve this include 1) managing, protecting and restoring areas within the panther's current range, 2) identifying areas within the historic range of panthers where reintroduction may be possible, and 3) managing panthers directly, through either captive breeding or genetic restoration, to offset negative consequences of inbreeding and small population size. Significant progress has been achieved under 2 of the 3 steps. Two decades of intensive panther research and monitoring has yielded a panther telemetry data set of >50,000 locations on 94 panthers and more than 200 published research papers and internal agency reports that detail findings on panther life history, ecology, and conservation needs. These data have been utilized to guide decisions regarding use of public lands, harvest of game species that also serve as panther prey, mitigating impacts of highways and new development, and identifying lands that have important panther conservation values. State and Federal land acquisition programs have brought 870,000 acres of panther habitat into public ownership since 1974. A genetic restoration plan has been implemented to mimic natural gene flow into the panther population. Currently, the U.S. Fish and Wildlife Service (FWS) has assembled a team to develop a spatially explicit habitat model that will further delineate key areas for conservation and will have application as a regulatory tool. A new recovery team has been appointed by the FWS to revise the recovery plan. The Florida Fish and Wildlife Conservation Commission and FWS will be working closely with other agencies and stakeholders to incorporate results from the genetic restoration study and the existing panther database into a coordinated management strategy for maintaining the current population. Reintroduction remains the final and crucial step toward panther recovery.

Land, E.D., D.B. Shindle, R.J. Kawula, J.F. Benson, M.A. Lotz and D.P. Onorato. 2008. Florida Panther Habitat Selection Analysis of Concurrent GPS and VHF Telemetry Data. J. Wildl. Manage. 72(3):633-639.

Abstract

Florida panthers (*Puma concolor coryi*) are listed as an endangered subspecies in the United States and they exist in a single Florida population with <100 individuals; all known reproduction occurs south of Lake Okeechobee. Habitat loss is the biggest threat to this small population and previous studies of habitat selection have relied on very high frequency (VHF) telemetry data collected almost exclusively during diurnal periods. We investigated habitat selection of 12 panthers in the northern portion of the breeding range using 1) Global Positioning System (GPS) telemetry data collected during nocturnal and diurnal periods and 2) VHF telemetry data collected only during diurnal periods. Analysis of both types of telemetry data yielded similar results as panthers selected upland ($P < 0.001$) and wetland ($P < 0.001$) forested habitat types. Our results indicated that forests are the habitats selected by panthers and generally support the current United States Fish and Wildlife Service panther habitat ranking system. We suggest that future studies with greater numbers of panthers should investigate panther habitat selection using GPS telemetry data collected throughout the range of the

Florida panther and with location attempts scheduled more evenly across the diel period. Global Positioning System radiocollars were effective at obtaining previously unavailable nocturnal telemetry data on panthers; however, we recommend that panther researchers continue to collect VHF telemetry data until acquisition rates and durability of GPS collars improve.

Lang, L.D., N. Tessier, M. Gauthier, R. Wissink, H. Jolicoeur and F. Lapointe. 2007. Current Situation of Cougars in Eastern Canada. Page 2 in Abstracts of Presentations of the 3rd Midwestern-Eastern Puma Conference, Trent University, Peterborough, Ontario.

Abstract

Cougars (Puma concolor couguar) once occupied a wide range in eastern North America. After European settlement, this felid species underwent a drastic decline in abundance. The last known cougar was reportedly killed in Maine, in 1938. Since then, most scientists considered the subspecies extinct. However, in the last two decades, sightings in eastern Canada increased exponentially, raising some doubts about the extinction of the cougar. Based on these multiple sightings, a nonequivocal identification technique was developed in order to assess the actual status of the cougar in eastern Canada. To do so, scratching posts combined with olfactive lure were installed in undisturbed areas, where the sightings were the most abundant. Then, we developed a molecular method using species-specific primers to identify samples and detect cougars. This method allowed the positive identification of ten cougars in eastern Canada. Now that we know the elusive species is present in eastern Canada, what type of protection measures will we have to take? This presentation will address some possible conservation issues.

Langley, R.J., V. M. Hirsch, S.J. O'Brien, D. Adger-Johnson, R.M. Goeken and R.A. Olmsted. 1994. Nucleotide Sequence Analysis of Puma Lentivirus (PLV-14): Genomic Organization and Relationship to Other Lentiviruses. Virology 202(2):853-864.

Abstract

The complete nucleotide sequence of an isolate of puma lentivirus (PLV-14) was obtained by an inverse polymerase chain reaction (I-PCR) technique and confirmed by conventional PCR. Both methods were used to amplify overlapping regions of proviral DNA, for cloning and sequencing, from genomic DNA isolated from PLV-14 infected Florida puma (Felis concolor coryi) peripheral blood mononuclear cells (PBMC). The provirus has a total length of 9100 nucleotides and the genomic organization of presumed protein coding regions are similar to those seen in other members of the lentivirus family, i.e., three large open reading frames gag, pol, and env as well as smaller intergenic regions that apparently encode regulatory proteins vif and 3' rev by positional and sequence similarity to those seen in other lentiviruses. Two additional open reading frames were identified in the env region and their function (if any) is unknown. The length of the PLV-14 long terminal repeat (LTR) was found to be shorter than the LTRs of feline immunodeficiency virus (FIV). The sequence homology between PLV-14 and other lentiviruses demonstrates that PLV-14 is most closely related to FIV from domestic cats. However, the extent of sequence divergence of each retroviral gene segment is large (e.g., percentage sequence similarity between FIV and PLV-14 env is 8% amino acid and 37% nucleotide similarity), indicating relatively ancient divergence of these feline lentiviral genomes.

Langohr, I.M., J.A. Ramos-Vara, C.C. Wu and S.F. Froderman. 2006. Listeric Meningoencephalomyelitis in a Cougar (Felis concolor): Characterization by Histopathologic, Immunohistochemical, and Molecular Methods. Vet. Pathol. 43(3):381-383.

Abstract

Listeria monocytogenes has been recognized as an important food-borne pathogen in animals. Records of the disease caused by this bacterium in large felids are, however, rare. The nervous form of listeriosis was diagnosed in a 12-year-old male cougar (*Felis concolor*) with a several-day history of neurologic disease characterized by excess salivation, head pressing, and circling that progressed to recumbency and death. Microscopically, the main alteration in the brain and spinal cord was a variably severe meningoencephalomyelitis composed mainly of mononuclear cell aggregates with fewer neutrophils. L. monocytogenes was isolated from the brain by microbiological culture, and L. monocytogenes antigen was detected in formalin-fixed, paraffin-embedded sections of brain and spinal cord by immunohistochemical analysis. On the

basis of the nucleotide sequence of the 16S rRNA gene, the isolated strain was determined to be serotype 1/2a. Food-borne transmission of the bacterium was suspected, but food was not available for testing.

Lankalis, J.A. 2006. Are There Leopards in America? Pages 108-112 in H.J. McGinnis, J.W. Tischendorf and S.J. Ropski editors. Proceedings of the Eastern Cougar Conference 2004, Morgantown, West Virginia, USA.

Abstract

During the past century, numerous anecdotal reports of black panthers have come from most parts of the United States, but not one report of a large black cat, except for large house cats, has ever been verified. Some incidents came close to being verified, but extenuating circumstances eerily seemed to prevail. The exact identities of the animals implicated in many black panther sightings is a mystery, but four candidates are possible. The lowly house cat (Felis silvestris catus) is not a large felid, but at a distance its size can be difficult to estimate. Jaguars (Panthera onca), cougars (Puma concolor), and leopards (Panthera pardus) are other possibilities. Although the leopard is not a native cat, it is capable of surviving in the climate of the northeastern USA. In 2002, a man discovered a large cat skull, claws, and other bones in the woods near Manchester, New Hampshire. At first the skull was believed to be from a cougar, but it is from a female leopard. This suggested that leopards might be responsible for some black panther sightings. This report will contrast the tracks and skull characteristics of leopards and cougars—the two most probable candidates to explain black panther sightings. This information may be conducive to the proper evaluation of solid evidence obtained from future reports of black panthers.

LaPointe, D. 1978. The Cat That Isn't. Michigan Nat. Res. Magazine. Jan./Feb. pp. 28-30.

The cougar supposedly became extinct in Michigan during the 19th century. The author discusses sightings made of cougars in the Upper Peninsula of Michigan. It is still controversial whether remnant populations of cougars exist in Michigan.

Larson, J.S. 1966. Panthers. Maryland Conservationist. 43(4):2-3.

An 1830 record of a cougar in Garrett County remained the last finding for the state of Maryland. Later reports of cougars from western Maryland lacked any concrete evidence and it is believed the cougar was completely exterminated from most of the state before 1800.

LaRue, M.A., 2007. Predicting Potential Habitat and Dispersal Corridors for Cougars in Midwestern North America. M.S. Thesis. Dept. Zoology, Southern Illinois University, Carbondale, IL, USA.

Since 1990, >130 confirmations (e.g., carcasses and photographs) of cougars (*Puma concolor*) have been recorded in midwestern North America. I created a model of potential cougar habitat in 9 midwestern states using geospatial data, expert-opinion surveys, and a GIS. Based on matrices of pair-wise comparisons involving habitat layers, 11 expert biologists were surveyed to rank habitat factors of importance to potential cougar habitat in the Midwest. I then used a GIS to analyze data and create a map of potential cougar habitat. I further determined potential dispersal corridors for cougars using least-cost path methods. About 8% of the study region contained highly suitable habitat (>= 75% suitability) for cougars. I identified 6 large, contiguous areas of highly suitable habitat for cougars (>= 2,500 km^2 in size with >=75% habitat suitability). The most likely least-cost path started in western Texas and branched to areas of suitable habitat in the Ouachita and Ozark National Forests.

LaRue, M.A. and C.K. Nielsen. 2008. Modelling Potential Dispersal Corridors for Cougars in Midwestern North America Using Least-Cost Path Methods. Ecological Modelling (212):372-381.

Abstract

Since 1990, cougar (*Puma concolor*) presence in midwestern North America has been increasing, with >130 confirmed cougar occurrences (i.e., tracks, photos, carcasses) being verified by professional wildlife biologists during this time. Because many of these confirmed cougar occurrences (>30%) have been carcasses of juvenile males, it is likely that

cougars are dispersing into the Midwest from established western populations. Although several wildlife biologists have acknowledged the possibility of cougar presence in the region, no research has been conducted regarding potential corridors that may facilitate dispersal. Therefore, our goal was to determine potential dispersal corridors for cougars in a 9-state portion of the Midwest using a habitat suitability model and least-cost path analysis. We modelled 2 km wide dispersal corridors from established western cougar populations to (1) large areas (≥2500km^2) of highly suitable cougar habitat, and (2) locations of confirmed cougar occurrences (*n* = 29) in North Dakota, Nebraska, and Missouri. The most likely dispersal corridor to large areas of highly suitable cougar habitat originated in western Texas and branched into the Ouachita and Ozark National Forests of Oklahoma, Arkansas, and Missouri. Within this corridor, road density was low (79m/km^2) and forests comprised 45% of land cover; these results are consistent with empirical studies that indicate dispersing cougars travel in habitat that provides cover while generally avoiding human influence. Corridor lengths from potential source populations to confirmed cougar occurrences ranged from 3 km to 1100 km, stream density (i.e., an index of riparian zones) ranged from 79m/km^2 to 249m/km^2, and grassland cover comprised >40% of corridors from occupied cougar habitat to confirmed occurrences. High grassland cover and riparian zones within these corridors may allow for movement between forest patches while dispersing through the highly agricultural Midwest. Our analysis provides the first description of potential dispersal corridors for cougars from established western populations into the Midwest. Primary benefits from this research include providing an understanding of landscape permeability for large carnivores in a largely unsuitable matrix, and presenting conservation agencies with useful information should cougars continue to disperse into the region.

Laundré, J.W., M. Sellers, T. Clark, and D.P. Streubel. 1991. Behavior, Ecology, and Conservation of Mountain Lions in Fragmented Habitat. Progress Rep., Dept. Biol. Sci., Idaho State Univ., Pocatello. 46pp.

Ten lions were treed during four winters in southcentral Idaho and northwestern Utah (2,500 km^2). Seven were adults (four females, three males) and three were kittens (two females, one male). All adults were fitted with radiocollars and released. One of the kittens was fitted with an expanding radio collar while the other two were only eartagged. Two adult females had home ranges of approximately 80 km^2. One of the two adult males had a home range of 230 km^2 while the other remained in a small (49 km^2) and rugged area of the Albion Mountains. Seventeen mule deer killed by lions had been located and included males and females, adults and juveniles, and animals in good and poor condition. Definite sign was found for 16 lions (8 adults, 8 kittens) on the study area during the 1989-90 winter. Daily activity patterns seemed to emulate the typical crepuscular pattern. In fragmented habitat, it appeared crucial that corridors between usable habitat patches be identified and protected from development.

Laundré, J.W., L. Hernández, D. Streubel, K. Altendorf and L. Gonzalez. 2000. Aging Mountain Lions Using Gum-Line Recession. Wildl. Soc. Bull. 28(4):963-966.

Abstract

The ability to accurately age mountain lions (Puma concolor) would be a valuable tool for management. However, no reliable or standardized technique is currently available. We tested the accuracy of using gum recession as an aging technique. We measured gum recession of the upper canine teeth in 13 known-age individuals (12 females, 1 male). Gum recession was significantly related to age in months (R^2 = 81.0, t_{28} = 10.16, P< 0.001). The 95% confidence intervals for age estimations of lions based on gum recession ranged from ±0.5 to 1.3 years. Gum recession appears to provide reasonably accurate ages for free-roaming mountain lions.

Laundré J. W. and L. Hernández. 2002. Growth Curve Models and Age Estimation of Young Cougars in the Northern Great Basin. J. Wildl. Manage. 66(3):849–858.

Abstract

We analyzed mass growth of 96 cougars (*Puma concolor*) from south-central Idaho and northwestern Utah with a Richards growth curve, tested the applicability of the curve for total body length and tail length, and tested whether changes in mass, total length, and tail length could be used to predict ages of young animals. The Richards curve provided good fits of the data for mass (M: R^2 = 0.986; F: R^2 = 0.966), total length (M: R^2 = 0.961; F: R^2 = 0.958), and tail length (M: R^2 = 0.949; F: R^2 = 0.948). The mass growth model analysis indicated differences in sex for adult mass, growth rate, and birth weight.

The growth model for total length indicated a sex effect for adult total length. The model for tail length was free of any sex effects. Separate simple linear regressions of the $\log_e$ (age) to the $\log_e$ (mass), $\log_e$ (total), and $\log_e$ (tail length) provided good fits of the data for males and females r^2_{mass} = 0.957 and 0938, $r^2_{total\ length}$ = 0.939 and 0.968, and $^{r2}_{tail\ length}$ = 0.918 and 0.955, respectively). We propose that models based on body mass, total length, and tail length are useful in studying the biology and ecology of cougar populations and developing sound management policies for this species.

Laundré, J. and T.W. Clark. 2003. Managing Puma Hunting in the Western United States: Through a Metapopulation Approach. Animal Conservation 6(2):159-170.

Abstract

To achieve long-term viability of hunted puma (*Puma concolor*) populations (even at historically low densities), we propose a management plan based on the metapopulation concept that designates source areas (closed to hunting) and sink areas (open to hunting). We use 11 years of data from Idaho and Utah to demonstrate how the proposed management plan might be implemented. We use minimum and maximum densities of resident animals to calculate minimum and maximum effective population sizes, neighborhood areas (regional management units) and usable habitat within the units. We designate sink and source areas based on their size, accessibility to hunters and juxtaposition. We show that closing 63% of puma habitat to hunting would ensure long-term puma population viability while permitting traditional hunting levels in other areas. This system could be adapted to existing state (and interstate) hunting management units, and we outline several steps by which wildlife agencies might set up a process (including public participation) to manage puma hunting.

Laundré, J.W. and L. Hernández. 2003. Winter Hunting Habitat of Pumas *Puma concolor* in Northwestern Utah and Southern Idaho, USA. Wildl. Biol. 9:123-129.

Abstract

Pumas *Puma concolor* are stalking predators of large ungulates that usually cache their prey. We hypothesize that they require specific habitats to successfully stalk their prey and that they select cache sites based on some set of criteria. We tested these predictions during a study of predation by pumas on mule deer *Odocoileus hemionus* in south-central Idaho and northwestern Utah, USA. We found cache points of puma-killed deer in winter by locating radio-collared pumas. We then located where pumas had killed deer (kill points) by tracks in the snow. We classified these kill points relative to the dominant forest type and association with open, edge or forested areas. At a subset of the kill points and associated cache points, we also estimated tree and shrub density, tree diameter at breast height (dbh), shrub height and slope. Pumas killed deer more often than expected ($P < 0.001$) in juniper-pinyon habitat and in edge areas. Tree densities and dbh at cache points were significantly greater ($P < 0.001$) than at kill points or surrounding areas. We concluded that pumas relied on specific habitat characteristics to kill mule deer, and selected cache sites with older, larger trees.

Laundré, J.W. and L. Hernández. 2003. Aging Cougars in the Field from Birth to Death. Page 66 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

The ability to accurately age mountain lions (Puma concolor) in the field would be a valuable tool for management. However, no reliable nor standardized technique is currently available. We tested the accuracy of using gum recession and mass gain as aging techniques. We measured gum recession of the upper canine teeth in 13 known-aged free ranging individuals (12 F, 1 M). Additionally, we fit body mass data from 94 known-aged cougars with a Richards curve function. Gum recession was first noticeable at approximately 20 months and was significantly related to age in months thereafter (R2 = 81.0; t28 = 10.16; $P < 0.001$). The 95% confidence intervals for age estimations of lions based on gum recession ranged from + 0.5 to 1.3 years. The Richards curve provided good fits of the data for mass (males: R2 = 0.958; females: R2 = 0.89). Weights became quite variable after approximately 14 months and could not be used as a reliable estimator of age. However, for animals < 14 months, the model performed well in back estimating ages. We proposed that with combined gum recession in adults and mass growth in kittens, biologists can accurately age mountain lions of almost all age classes.

Laundré, J.W. and L. Hernández. 2003. Energetics of Free Roaming Mountain Lions in the Great Basin. Page 67 *in* L. A.

Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

Estimating energetics of free roaming animals has many obvious benefits relative to their management, e.g. estimating food resource needs, carrying capacity, etc. This is additional true for large predators such as mountain lions (Puma concolor) whose food base often are ungulates that are also popular game species. In this case, energetics calculations could help provide estimates of the impact mountain lions might have on these species. Previous energetics calculations were based on broad categories of lion activity (resting, walking, running) and estimates of time budgets in each. Here we present energetic estimates based on actual activity levels as determined via radio telemetry. We relocated selected animals every half hour over 24 hours and used these data to calculate distance moved. Estimates of distance moved were converted to amount of energy expended via standard physiological formulae. These data were then used to calculate a total daily and annual energy budget for females and males and then used to estimate annual prey needs. The results of these calculations will be presented.

Laundré, J.W. and L. Hernández. 2003. Habitat Composition of Successful Kill Sites for Lions in Southeastern Idaho and Northwestern Utah. Page 67 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

It is well known that mountain lions (Puma concolor) stalk their prey, specifically, deer (Odocoileus spp.) and elk (Cervus elaphus). Because of this predatory behavior, they need to remain concealed from their prey until they approach to within striking distance (estimated by many to be 20-25 m). As not all types of habitat can provide the needed cover for such approaches, we predicted that the sites where lions successfully killed animals should have specific structural characteristics (e.g. tree/shrub density) that aid lions in their hunting efforts. For 65 sites where we verified that lions killed mule deer, we subjectively classified them as either being in the open (>25 m from the nearest forest), edge of the forest (<25 into the open and < 15 m into the forest), and within the forest (> 15 m into the forest). Of these, 72% were in the edge of the forest and 14% each in the open and forest areas. We also quantified the structural characteristics of each site relative to tree and shrub density and shrub height. The sites objectively classified as edge differed significantly in tree density and shrub height from those classified as open and forest. Thus we concluded that edge or edge like habitat constituted successful hunting habitat for lions. We suggest the reason for this is that this type of habitat structure provides the lions with the visibility needed to locate their prey at a distance but still provide the cover they need to make a successful approach.

Laundré, J.W. and L. Hernández. 2003. Long Term Population Trends of Mountain Lions in Southeastern Idaho and Northwestern Utah. Page 68 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

Between 1987 and 2000 we studied mountain lions (Puma concolor) in a 2000 km^2 area in southeastern Idaho and northwestern Utah. Each winter we spent extensive time in the field trapping lions and also interacted with other lion hunters in the area. Based on our field efforts and the information provided by others, we were able to obtain a reliable estimate of the minimal number of lions present in our area. We found that numbers of adult lions varied in a cyclic pattern, reaching a high in 1996 and then declining again. The increase in lions was attributed to the high deer numbers in the area while the decline was a result of high winter mortality of deer in 1994. As harvest levels were relatively constant over the time, the decline was attributed to low recruitment of young individuals in 1996-1998 and additional mortality due to starvation. Our data suggest that lion numbers are self regulated and controlled by the deer population, with the survival of young individuals being the most susceptible to declines in deer numbers.

Laundré, J.W., L. Hernández and T. Clark. 2003. Regulating Hunting of Mountain Lions: A Metapopulation Approach. Page 68 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

Traditionally there are three methods of regulating mountain lion (Puma concolor) harvest. The first is no control (unlimited in time and numbers or unlimited in numbers within a specific season) and relies on low hunter effort/success to prevent over harvest. The second is a permit system that specifies a certain number of permits which are assigned via a lottery system. The third is a quota system where the taking of a certain number of females closes the season. Of these approaches, the least defendable to a court challenge is the first because it has no safeguard to prevent over harvest. Although the second two methods provide protection to the base population (permit numbers and quota levels can be changed), the degree of protection is strongly dependent on accurate assessments of population levels of lions. As accurate assessment techniques have yet to be developed, these two methods are also susceptible to court challenges. We propose a fourth management approach that incorporates the metapopulation concept of source and sink populations. Source populations would consist of areas (hunting units) where the take of lions would be prohibited except for damage control. Sink populations would be areas open to hunting. Dispersal of individuals from the source populations would replenish sink populations. This system of management would insure a secure base level population regardless of the hunting pressure exerted in the sink areas. Such a system also does not rely on accurate estimates of population levels. An example of this approach is presented and discussed.

Laundré, J.W. and L. Hernández. 2003. The Application of a Richards Curve Growth Model to Cougars in the Northern Great Basin. Page 69 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

Previous applications of a Richards curve for cougars (Puma concolor) indicated its possible use in modeling mass growth. Use of such a model could be helpful in estimating energetics and productivity of cougar populations. The final model incorporated sex and population effects for adult mass and population effects for growth rates. However, additional analyses were recommended to improve on the model, especially in estimating birth mass. We analyzed mass growth of 94 cougars from south-central Idaho and northwestern Utah with a Richards curve. We also tested the applicability of a Richards curve for total body length and tail length. The Richards curve provided good fits of the data for mass (males: R2 = 0.958; females: R2 = 0.89), total length (males: R2 = 0.949; females: R2 = 0.913) and tail length (males: R2 = 0.93; females: R2 = 0.92). The model for mass growth provided a reasonable (0.34 kg) estimate of birth mass. The analysis also indicated that mass growth rates differed between the sexes. The proposed growth model for total length included a sex effect for adult total length. The model for tail length was free of any sex or population effects. We proposed that all three models could be useful in studying the biology and ecology of cougar populations.

Laundré, J.W. 2003. Use of Dispersal Distance to Assess the Long Term Conservation of Mountain Lions. Page 69 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

Dispersal is an important conservation concern, especially regarding large mammalian carnivores. An importance aspect of dispersal is effective population size (Ne). We tested if Ne could be applied to a regional conservation strategy, by using the dispersal patterns of mountain lions (Puma concolor) in Northwestern United States. We determined dispersal distance and endpoints of 28 (12 M, 16 F) mountain lions. Twelve females exhibited philopatry. Dispersal distances of the remaining individuals averaged 160.7, SE = 37.4 km for males and 89.2, SE = 28.0 km for females. Inbreeding effective population size (Ne) was 1,076 resident individuals in a neighborhood area of 107,600 km^2. Within this area, habitat types under control of the U.S. Forest Service and U.S. Bureau of Land Management areas provided the important landscape elements for maintaining the existing dispersal patterns. Urban areas and cultivated landscapes greatly impacted pumas' ability to disperse. We concluded that to maintain current dispersal patterns, it is necessary to maintain the existing landscape of public multiple use lands. This type of analysis can be a pro-active tool in preventing the decline of a species.

Laundré, J.W. and L. Hernández. 2003. Impact of Edge Habitat on Home Range Size in Pumas. Page 119 *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 previous workshop in San Antonio, researchers from Wyoming reported that pumas from two areas with different amounts of fragmentation still had home range areas that contained equal amounts of periphery (= edge). In the same workshop, we reported that edge habitat was critical for successful hunting of deer by pumas. These two results indicate that the amount of edge habitat in an area may be an important factor in determining home range size of pumas. We tested this hypothesis with data we have on home ranges of pumas in southern Idaho/northwestern Utah. The study area is highly fragmented into forest patches and sagebrush open areas. We tested three predictions: 1) the amount of edge habitat in the home ranges of pumas would be similar, regardless of the size of the home range, 2) the percent of edge would be negatively related to home range size, and 3) there would be more edge habitat within home range boundaries than in general areas of similar size. We tested these predictions by overlaying telemetry locations on habitat maps of the area, determining the home range boundaries with the minimum convex polygon method and then estimating the amount of forest edge (km^2) that occurred in each home range. The analysis was conducted with standard GIS software and we had 20 pumas where the home range was adequately determined (> 30 relocations). Home range size varied from 38 to 120 km^2. However, 14 (70%) of the home ranges were between 38 to 105 km^2. The amount of edge habitat within all the home ranges varied from 13 to 35 km^2. Within the 14 smaller home ranges, the amount of edge varied from 13 to 20 km^2. The percent of edge within home ranges was negatively correlated with home range size. The amount of edge within the home range boundaries was significantly greater ($F = 15.05$, $P < 0.001$) than general areas of similar size. We concluded that the amount of edge within an area was influencing the size of home ranges. We proposed that pumas needed a certain minimum amount of edge (hunting habitat) to successfully hunt their prey and that the amount of "catchable" prey was more important than just general prey abundance.

Laundré, J.W. and L. Hernández. 2003. Factors Affecting Dispersal in Young Male Pumas. Pages 151-160 *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

Numerous studies have demonstrated that nearly all young male pumas disperse from their natal home range area while most females are philopatric. There are 2 hypotheses for the driving force behind dispersal in young male pumas. The first is the competition (aggression avoidance) model where dispersal is because of competition between young males and their fathers/incoming transient males for mates and resources. The second is the inbreeding model where young males are thought to disperse to avoid inbreeding with their mothers/sisters. Under each model, specific predictions can be made to test their validity. Under the competition model, we predict that there should be physical conflicts between sons and their fathers, including infanticide and that competitive ability should increase with age and thus, the longer time and further distance they are from their home area. Thus, dispersal distances should reflect their competitive ability, i.e. few males will establish territories close to their natal home range. Under the inbreeding avoidance model, we predict fewer physical conflicts (young males leave on their own), no inbreeding between fathers and daughters, which is genetically equivalent to sons mating with their mothers, and no males should establish their territories adjacent (1-2 home range diameters) to their natal home range. We tested these predictions with dispersal data from our study in southern Idaho/northwestern Utah and published data. We refuted the inbreeding model because resident males do fight and kill their male offspring, resident males do mate with their daughters, and there is a high percent of males that establish their territories within 2-4 HRDs of their natal home ranges. Our data supported the competition model with an increase in frequency of dispersal distances at >2 diameters. We conclude that young males are forced out of their natal home range by their fathers or incoming males who, by default, will be older and stronger. We propose that they continue to disperse until they gain enough weight and experience to successfully takeover a territory.

Laundré, J.W. and L. Hernández. 2005. Impact of Pumas on the Recovery of a Population of Mule Deer in Southern Idaho. Page 155 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

Mule deer *(Odocoileus hemionus)* populations in many western states declined between 40 to 60% over the winter of 1992-93. To date, over 10 years later, these populations have not recovered significantly in many areas. One of the major

factors being blamed for the lack of recovery is predation by pumas *(Puma concolor*). This assumption has driven puma harvest policies in many states to reduce puma numbers to aid deer recovery. We have estimates of puma numbers in our study area for 15 years (1988-2002), which encompassed the deer decline. We also have estimated deer consumption rates for pumas. We coupled these data with data from Idaho Fish and Game reports on deer numbers and other published studies to test if pumas were preventing the recovery of deer in our study area. Puma numbers in our area between 1992 and 2002 ranged from 12 to 21 adult animals. Predation rates of pumas on mule deer varied from 246 to 443 deer/year. These predation levels were approximately 2.0% of the deer population before the decline and 4.0% after the decline. Our estimation of the impact of pumas on mule deer recovery demonstrated that pumas, even at unusually high densities (3 pumas/l00 km^2), will only slow recovery by 2-3 years and not suppress deer numbers. We found positive regression relationships of the percentage of winter mortality of fawns (r^2 = 0.62, P < 0.001) and adult female deer (r^2 = 0.68, P < 0.001) with December-January snowfall. When incorporated in our calculations, these relationships produced a pattern of deer population change that closely matched estimates from our study area based on field survey data. When we artificially reduced puma numbers by 50%, we found it did not help recovery and deer numbers still declined in years of above average winter snowfall. We concluded that pumas were not contributing to the suppression of deer numbers after the decline of 1992-93. The main causative factor preventing recovery of deer in our area was winter snowfall. The management implications of these results will be discussed.

Laundré, J.W. 2005. Puma Energetics: A Recalculation. J. Wildl. Manage. 69(2):723-732.

Abstract

I used estimates of energetic requirements of pumas (*Puma concolor*) to estimate prey requirements for mule deer (*Odocoileus hemionus*). This estimate might help explain the impact pumas may have on deer populations. Accepted daily energy demands of pumas result in estimates of annual kill rates per puma of 44 to >100 mule deer/yr. However, recent studies of puma activity indicate that the methods used to calculate these earlier values may have been flawed. To test this possibility, I used a more recently developed allometric equation to calculate energy demand of pumas based on movement data from a radio telemetry study in south-central Idaho and northwestern Utah. I calculated energy demand for 20 adult female and 8 adult male pumas based on their movements during 95 monitoring blocks of 24 hrs. I then calculated prey requirements for individuals and for low and high population estimates from the study area. I estimated that daily energy demands for male pumas (3,143.7 ± 120.1 kcal; 13,203.5 kilojoules; kJ) and female pumas with kittens (2705.4 ± 57.0 kcal; 11,362.7 kJ) were substantially lower than previously reported estimates of approximately 5,500 kcal/day (23,100 kJ/day) for males and females with an average (2.6 kittens) litter size. The resulting estimated annual kill rates (19.4 deer/yr for males, 39.6 deer/yr for females with kittens) were also substantially lower than previous estimates (44 deer/yr and 73 deer/yr respectively). I demonstrated that the earlier energy demand estimates were based on overestimations of puma activity for these 2 social groups and that my estimates of activity, and thus energy demand, are more biologically reasonable for pumas. I discuss the need for a reassessment of the impact pumas can have on deer populations in light of these new energy calculations.

Laundré, J.W., L. Hernández and S.G. Clark. 2006. Impact of Puma Predation on the Decline and Recovery of a Mule Deer Population in Southeastern Idaho. Can. J. Zoology 84(11):1555-1565.

Abstract

We modeled the impact of puma (*Puma concolor* (L., 1771)) predation on the decline and recovery of mule deer (*Odocoileus hemionus* (Rafinesque, 1817)) in southern Idaho based on estimates of puma numbers, predation rates of pumas, and reproductive variables of deer. Deer populations peaked in 1992–1993, then declined more than 55% and remained low for the next 11 years. Puma numbers peaked 4–6 years after deer populations peaked but then declined to original levels. Estimated puma predation on the deer population before and after the decline was 2.2%–3.3% and 3.1%–5.8%, respectively. At high puma densities (>3 pumas/100 km^2), predation by pumas delayed deer recovery by 2–3 years. Percent winter mortality of fawns (r^2 = 0.62, P < 0.001) and adult female deer (r^2 = 0.68, P < 0.001) correlated positively with December–January snowfall. Incorporation of winter snowfall amounts in the model produced a pattern of deer population change matching estimated changes based on field survey data. We conclude that pumas probably were a minor factor in the decline of the deer population in our area and did not suppress deer recovery. We propose that winter

snowfall was the primary ultimate and proximate factor in the deer decline and suppression of their recovery.

Laundré, J.W. and L. Hernández. 2007. Do Female Pumas (*Puma concolor*) Exhibit a Birth Pulse? J. Mammal. 88(5):1300-1304.

Abstract

Female pumas (Puma concolor) give birth in all months of the year with a possible birth pulse in July–September. This pulse is proposed to be timed to provide increased survival probabilities to young born during these months. We tested data on birth dates from 8 different studies for a birth pulse. We also compared survival rates for young born in July–September to those for young born outside of these dates during a 17-year study in Idaho and Utah. The distribution of litters born per month was not uniform, with 41% of births occurring in July–September. Survival rates of young born in July–September were equal to those in other months of the year (0.774 ± 0.006 versus 0.779 ± 0.004). We conclude that there was a propensity for higher numbers of litters to be born in July–September. However, we rejected the hypothesis that young born in July–September had greater survival than young born at other times of the year. We suggest that rather than there being a survival advantage to pumas born in July–September, perhaps there is a survival disadvantage to those born in January–February (4.5% of 484 litters). However, there were insufficient data to test this alternate hypothesis.

Laundré, J.W., L. Hernández and S.G. Clark. 2007. Numerical and Demographic Responses of Pumas to Changes in Prey Abundance: Testing Current Predictions. J. Wildl. Manage. 71(2):345-355.

Abstract

Information on factors affecting population size of pumas (*Puma concolor*) can be important because their principal prey over most of the western United States are valued big game species (e.g., mule deer [*Odocoileus hemionus*], elk [*Cervus elaphus*], and bighorn sheep [*Ovis canadensis*]). Based on the hypothesis that puma numbers are limited by their food supply, puma populations should track changes in prey abundance by growing exponentially with increases in prey and by declining with a lag response when prey decreases. Additional predictions proposed by researchers are that body mass of pumas, female productivity, kitten survival, and adult survival should decrease after a prey decline. We used a 15-year database from a hunted population of pumas in southern Idaho and northwestern Utah to test these predictions. During the 15-year time span of the database, a major decline in mule deer abundance occurred. Estimates of puma numbers and demographic characteristics came from intensive capture and radiocollaring efforts. We calculated kitten and adult survival with MICROMORT software. We found that adult puma numbers increased exponentially at $r = 0.07$ during a period of increasing mule deer numbers. Four years after the mule deer abundance declined, puma numbers decreased at a rate of $r = -0.06$. Body mass of female pumas was lower after the decline in puma numbers (42.6 ± SE = 1.2 kg, $n = 40$ vs. 40.1 ± 0.64 kg, $n = 34$, $t = 5.06$, $P = 0.045$). Kitten survival was less after the decline in deer abundance (0.573 ± 0.016, $n = 30$ vs. 0.856 ± 0.015, $n = 25$, $Z = 2.40$, $P < 0.01$). Survival of resident females was significantly less after the decline in puma numbers (0.783 ± 0.03 vs. 0.929 ± 0.019, $U = 55.0$, $P = 0.009$). Female productivity did not differ before or after the decline in deer abundance. Our results supported the majority of the predictions concerning the impact of changing deer abundance, which supported the hypothesis that the abundance of mule deer limited our population of pumas.

Laundré, J.W. and J. Loxterman. 2007. Impact of Edge Habitat on Summer Home Range Size in Female Pumas. The American Midland Naturalist 157(1):221-229.

Abstract

Results of recent studies have indicated that the amount of edge habitat in an area may be an important factor in determining home range size of pumas. We tested this hypothesis with data on home ranges of pumas in southern Idaho/northwestern Utah. The study area is highly fragmented into forest patches and sagebrush open areas. We tested three predictions: (1) the percent of edge would be negatively related to home range size, (2) the amount of edge habitat in the home ranges of pumas would be similar, regardless of the size of the home range and (3) there would be more edge habitat within home range boundaries than in general areas of similar size. Home range size (90%) varied from 29.8 to

118.7 km^2. The percent of edge within home ranges was negatively correlated with home range size ($F = 22.3$, $P < 0.001$, $R^2 = 0.53$), but amount of edge habitat within the home ranges was not. The mean percent of edge within home range boundaries (16.0 ± 1.4 (se) %) was significantly greater ($t = 2.88$, $P = 0.006$) than general areas of similar size (11.3 ± 1.2%). We concluded that the amount of edge within an area was influencing the size of home ranges. We proposed that pumas needed a certain minimum amount of edge (hunting habitat) to successfully hunt their prey and that the amount of "catchable" prey was more important than just general prey abundance.

Laundré, J.W. 2008. Summer Predation Rates on Ungulate Prey by a Large Keystone Predator: How Many Ungulates Does a Large Predator Kill? J. Zoology 275(4):341-348.

Abstract

Estimates of predation rates by large predators can provide valuable information on their potential impact on their ungulate prey populations. This is especially the case for pumas *Puma concolor* and its main prey, mule deer *Odocoileus hemionus*. However, only limited information on predation rates of pumas exist where mule deer are the only ungulate prey available. I used VHF telemetry data collected over 24-h monitoring sessions and once daily over consecutive days to derive two independent estimates of puma predation rates on mule deer where they were the only large prey available. For the 24-h data, I had 48 time blocks on female pumas with kittens, 43 blocks on females without kittens and 30 blocks on males. For the daily consecutive data, the average number of consecutive days followed was 51.5 ± 4.2 days. There were data on five female pumas with kittens, five pregnant females and nine females without kittens. Predation rates over an average month of 30 days from the 24-h monitoring sessions were 2.0 mule deer per puma month for males (15.1 days per kill), 2.1 mule deer per puma month (14.3 days per kill) for females without kittens and 2.5 mule deer per puma month (12.0 days per kill) for pregnant females and females with kittens. For the consecutive daily data, females without kittens had an estimated predation rate of 2.1 ± 0.14 mule deer per puma month (14.9 ± 0.90 days per kill). Pregnant and females with kittens had predation rates of 2.7 ± 0.18 and 2.6 ± 0.21 mule deer per puma month, respectively (11.4 ± 0.72 and 12.0 ± 1.1 days per kill, respectively). Predation rates estimated in this study compared with those estimated by energetic demand for pumas in the study area but were lower than other field derived estimates. These data help increase our understanding of predation impacts of large predators on their prey.

Laundré, J.W. and L. Hernández. 2008. The Amount of Time Female Pumas *Puma concolor* Spend with Their Kittens. Wildlife Biology 14(2):221-227.

Abstract

In the sport hunting of pumas Puma concolor, most states and provinces of the United States and Canada do not allow the killing of females with kittens. However, female pumas can be away from their kittens and, if detected by hunters at these times, can be mistakenly killed. To assess the extent to which females with kittens might mistakenly be killed we need to have estimates of the percent of time female pumas are with their kittens on a daily basis. Previous estimates range within 52-83%, but are based on simultaneous locations taken during the day when pumas are least active. To provide a more accurate assessment of the amount of time females spend with their young, we analyzed telemetry data collected over 24, 24-hour blocks for 15 females and their kittens. We collected data from June to September during 1989-1999 in southeastern Idaho and northwestern Utah. We found that females with 7-12 month-old kittens were within 200m of their kittens an average 16.2 ± 3.8% (N=12) of the time. These females were >1.0km from their kittens 30.9 ± 6.7% of the time. Three females with kittens in dens were near their dens 10.3, 12.2 and 2.3% of the time. Females were within 200m of their kittens the least amount of time (5.1 ± 2.1%, N=8) during 11:00-14:30 and the most amount of time during 23:00-01:30 (29.4 ± 3.0, N=6) and 07:00–10:30 (23.2 ± 3.1%). We conclude that the probability that a hunter would encounter a female without her kittens was >80%.

Laundré, J.W., J.L. Salazar, L. Hernández and D.N. López. 2009. Evaluating Potential Factors Affecting Puma *Puma concolor* Abundance in the Mexican Chihuahuan Desert. Wildlife Bilogy 15(2):207-212.

Abstract

The distribution and abundance of pumas *Puma concolor* within mountain ranges of similar size in the Mexican Chihuahuan desert is known to vary. In 2001–2002, we tested 11 variables pertaining to habitat composition, prey abundance and anthropogenic factors to identify which ones might explain the difference in puma abundance between two mountain ranges (El Cuervo and Sierra Rica) of similar size. We found that shrub density (32.2±1.9 (SE) vs 30.0±1.7 shrubs/km^2) and diversity (2.1±0.1 vs 1.9 ± 0.1) did not differ between the two ranges. However, El Cuervo had significantly lower density of mule deer *Odocoileus hemionus* (158.3 ± 62.6/km^2 vs 703.3± 296.1/km^2) and collared peccary *Tayassu tajacu* (5.0 ± 2.8/km^2 vs 146.7± 70.1/km^2) faecal groups than Sierra Rica. Conversely, anthropogenic factors such as road density (52.4 km/100 km^2 vs 43.9 km/100km^2), town density (25 towns/100 km^2 vs 6 towns/100 km^2) and human density (6 individuals/100 km^2 vs 0.08 individuals/100 km^2), were higher for El Cuervo than for Sierra Rica. We hypothesized that anthropogenic factors were the most important in explaining the difference in abundance of pumas between the two ranges. We propose that the higher number of people and accessibility to El Cuervo results in a high incidence of illegal hunting which suppresses prey and puma populations. We discuss the consequences of our results to the conservation of pumas in the Mexican Chihuahuan desert.

Lawrence, R.D. 1989. Is the Eastern Cougar Making a Comeback? Canadian Geographic 109(4):32-33.

Repeated tales of sightings of the eastern cougar fueled uncertainty about its fate in spite of there being no conclusive evidence for more than a decade. In 1954, the author found tracks in the snow of an animal he believed to be a cougar in the Nagami River region of Ontario, some 70 kilometres west of Hearst. He reported the evidence he had found but was told that the cougar had been extinct in Ontario since before the turn of the century. Seven years later the author saw an eastern cougar along a stream that feeds White Lake. Another eastern cougar was spotted by the author in 1969, 900 metres north of a small lake that feeds the Mattawa River. The author wrote a book entitled "The Ghost Walker" after completing a nine-month study of cougars in British Columbia. Helen Gerson noted that between 1935 and 1983 reports have been made of 318 sightings in Ontario, including some of cougars with kittens. In addition, 260 sightings took place in Manitoba between 1920 and 1975, and in 1973 a specimen was killed only 82 kilometres from the Ontario border. Sightings and/or sign have also been reported in Minnesota and Quebec. There have been more than 200 sightings in both New Brunswick and Nova Scotia since 1977, with 61 in 1988.

Laycock, G. 1988. Cougars in Conflict. Audubon. March. Pgs. 88-95.

By the 1600's, Jesuit priests in lower California were offering the natives one bull for every mountain lion killed. California began paying $20 bounties on mountain lions in 1907, and in 1919 employed hunters and their dogs to kill mountain lions. The bounty continued until 1963 and in 1969 the lion was protected as a big-game animal. In 1972, a moratorium was enacted on lion hunting which continued until 1987, when a limited hunt was proposed but was blocked by the courts. Lion numbers appeared to be increasing since the moratorium. Confirmed incidents of lion depredation increased from five in 1971, fifteen in 1975, forty-one in 1980, and 138 in 1985. In British Columbia, the possibility of a close encounter with a cougar is a fact of life. More than two dozen attacks have been listed since 1914, most on Vancouver Island and four have proven fatal. Accounts of attacks on humans by mountain lions are rare and several of these attacks are described. In 1986, Janice E. Schmidt, a student at the University of California at Davis, searched old records and found a total of 66 attacks, 23 of which were fatal, from 1750 to 1986. In a recent 18-month period, the Orange County, California Animal Services Department logged 51 reports of lion sightings.

Layne, J.N., and M.N. McCauley. 1976. Biological Overview of the Florida Panther. Pgs. 5-45 <u>In</u>: Proceedings of the Florida Panther Conference, P.C.H. Pritchard (ed.). Orlando, Fl. 121pp.

The biology of the Florida panther was poorly known, despite many years of a precarious existence. Over 200 unpublished alleged panther records were reviewed in Florida in addition to literature searches dating back to 1935. Reliability was rated on a 4-point scale, ranging from most to least reliable and represented 5 percent, 31 percent, 43 percent, and 19 percent, respectively. <u>Felis concolor coryi</u> Bangs was one of the 30 recognized subspecies, named by Outram Bangs in 1899 after Charles B. Cory, a prominent sportsman and scientist associated with the Field Museum of Natural History in the 1800's. The type locality was designated by Bangs as the "wilderness back of Sebastian." In his original description, Cory noted that the Florida panther had relatively long legs and small feet. Several northern specimens examined had a foot at least 4 inches wide while those in Florida would not be over 3 inches. It appeared that the relative length of the forelegs in <u>coryi</u> was larger when compared with other races, and may be an adaptation to wetland habitats. In addition,

tail length may be shorter than some other populations. The pelage is relatively dark and characterized by short, stiff hairs and is typically rusty on the back, fulvous on the sides, and pale below. The only case of melanism actually known from the entire range of F. concolor is from Brazil. The panther is known in the fossil record of Florida from Pleistocene sites in Brevard, Gilchrist, Marion, and Pinellas Counties. Many apparently valid records suggest that if not harassed, panthers can live in close proximity to humans, but some of these records may be from dispersing young individuals. Panthers were probably still relatively abundant at the beginning of the 1900's, although their numbers were apparently already reduced in north Florida. Estimates of the number statewide range from about 30 to 300 and the number of reports of alleged panther occurrences in Florida over the previous 20 years had shown a steady increase as well as in other parts of the southeast. Persecution by man appears to have been the primary cause of the decline of the Florida panther, and illegal killing and highway mortality probably continue to be the major forces depressing the population below the carrying capacity. The Texas cattle fever tick eradication program in the late 1930's and early 1940's in which thousands of deer were slaughtered may have had a direct effect on panther populations. However, due to the subsequent increased human pressure on the panther population due to anticipated increases in panther attacks on livestock may have been equally or more severe.

Layne, J.N. and D.A. Wassmer. 1988. Records of the Panther in Highlands County, Florida. Florida Field Naturalist 16:70-72.

Panther (Felis concolor) sign was documented at two localities in Highlands County in south-central Florida in August and October 1987. Tracks and associated scat were found on the Archbold Biological Station 12 km south of Lake Placid. Tracks were also discovered on the Scarborough Ranch 13 km southeast of Lake Placid and approximately 13 km northeast of the previous location. The size of the tracks at both localities indicated the presence of a male (probably the same individual) as the heel pad of adult males is >50 mm in width. These tracks and scats constitute the first confirmed records of panther in Highlands County in recent years despite numerous sightings. The Glades County and Highlands County areas are probably part of a single panther population unit and they are broadly continuous with the Big Cypress-Everglades region which contains the most consistently documented panther population in Florida. As an addendum: after finding additional tracks, presumably of the same male panther, a young adult male was captured and radiocollared on January 30, 1988 by the Florida Game and Fresh Water Fish Commission's panther research team.

Leatham, J.P. 1983. The Utah Cougar Harvest Book, 1982-83. P-R Proj. No. W-65-R-D-31, Job A-7, Publication No. 83-11. Utah Dept. Nat. Resources.

SUMMARY

There were 506 cougar permits sold in 1982-83. This represents a 3 percent increase when compared to 492 permits sold during the 1981-82 season. Non-residents purchased 137(27%) permits and residents purchased 369(73%). Twenty-four out of the 506 permits were valid for specific areas only. The total cougar harvest for 1982-83 was 179 cougar, including 7 cougar taken due to livestock depredation. Two of these depredating cougar were taken by government trappers in Morgan County where there is a restriction of two permits issued to hunters. The cougar harvest of 179 is 17% less than the 216 harvested in 1981-82. There were an estimated 435 hunters afield in 1982-83 compared to 432 in 1981-82. These permitees spent 3,278 hunter-days afield while hunting cougar, a decrease of 7 percent from 1981-82. Hunter success was 54 percent.

Leatham, J.P. 1985. Utah Cougar Harvest, 1983-84. P-R Proj. No. W-65-R-D-32, Job A-7, Publication No. 85-10. Utah Dept. Nat. Resources.

There were 529 cougar permits sold in 1983-84. This represents a 5 percent increase when compared to the 506 permits sold during the 1982-83 season. Non-residents purchased 171 (32%) permits and residents purchased 358 (68%). Twenty-six out of the 529 permits were valid for specific areas only. The total cougar harvest for 1983-84 was 221 cougar, including 10 cougar taken due to livestock depredation. Three of these depredating cougar were taken by livestockmen and government trappers in Morgan County where there was a restriction of two permits issued to hunters. The cougar harvest of 221 is 23 percent more than the 179 harvested in 1982-83. There were an estimated 484 hunters afield in 1983-84 compared to 435 in 1982-83. These permitees spent 3,874 hunter-days afield while hunting cougar, an increase of 18% from 1982-83. Hunter success was 44 percent.

Leberg, P.L., M.R. Carloss, L.J. Dugas, K.L. Pilgrim, L.S. Mills, M.C. Green and D. Scognamillo. 2004. Recent Record of a Cougar (*Puma concolor*) in Louisiana, with Notes on Diet, Based on Analysis of Fecal Materials. Southeastern Nat. 3(4):653-658.

Abstract

We report a sighting, supported by DNA evidence from a scat, of a cougar (*Puma concolor*) in southeastern Louisiana. The 16S-rRNA genotype obtained from mtDNA is one that is common throughout North America, making it difficult to determine the origin of the individual. Based on DNA and hair scale analysis, the scat contained the partially digested remains of a dog (*Canis familiaris*) and an eastern cottontail (*Sylvilagus floridanus*), indicating that the individual was successfully foraging on locally occurring prey.

LeCount, A.L. and W.J. Zimmermann. 1986. Trichinosis in Mountain Lions in Arizona. 1986. J. Wildl. Dis. 22(3):432-434.

The mountain lion in Arizona (Felis concolor azteca) had not been sampled prior to this investigation for the presence of trichinae. Samples were collected from 18 lions (13 males, 5 females) from 4 counties and trichinae were found in 66.7% (12/18) and represent a prevalence and intensity much higher than those reported in other studies. Although the source of infection was not identified, it appeared possible that the skunks (Spilogale gracilis) and (Mephitis mephitis) are both vectors and that hounds used in hunting lions may be at risk unless the mountain lion meat that they are fed is cooked.

Lee, D.S. 1979. North Carolina State Museum's Panther Survey Program. Pgs. 2-3 In: Eastern Cougar Newsletter, R.L. Downing (ed.), USDI, Fish and Wildl. Service, Dept. Forestry, Clemson Univ., Clemson, SC. January.

The occurrence of the panther (Felis concolor) had been researched by the North Carolina State Museum for the previous 4 years. Historic statewide distribution was documented and over 300 potentially valid reports were compiled with about 20% of these reports originating from observers of known reliability under optimum conditions. Nearly 1000 posters asking for sightings were distributed in 1976. Reports were generally clustered in the southeastern counties, the northern portion of the Uwharrie National Forest, and several regions in the extreme western part of the State.

Leite, F.L., T.A. de Paula, S.L. da Matta, C.C. Fonseca, M.T. das Neves and J.B. de Barros. 2006. Cycle and Duration of the Seminiferous Epithelium in Puma (Puma concolor). Anim. Reprod. Sci. 91(3-4):307-316.

Abstract

Puma or sussuarana (*Puma concolor*) is the second largest feline in the American continent and has an ample latitudinal distribution in very diverse habitats. In relation to its conservation status, the puma is considered an extinction-threatened species. The study of the testis morphology and the spermatogenic process in a species is fundamental for establishing the physiologic patterns that will make possible the selection of the protocols for assisted reproduction. A number of peculiarities associated with the reproductive biology of specific species such as the duration of spermatogenic process can be used to determine the frequency of sperm collection. Nine adult male pumas maintained in captivity were used to determine the relative frequency of stages in the seminiferous epithelium cycle. Three of them received intra-testicular injections of 0.1ml tritiated thymidine to determine the duration of the seminiferous epithelium cycle, and were subjected to biopsy 7 days later. The cycle of the seminiferous epithelium in puma was didactically described into eight stages by the tubular morphology method. The total duration of one seminiferous epithelium cycle in puma was calculated to be 9.89 days, and approximately 44.5 days are required for development of spermatozoon from spermatogonia. The duration of spermiogenesis, prophase and other events of meiosis were 14.08, 15.20 and 1.79 days, respectively. The relative frequency of the pre-meiotic, meiotic and post-meiotic phases were 3.98, 1.79 and 4.12 days, respectively.

Lemelin, H. 2009. Doubting Thomases and the Cougar: The Perceptions of Puma Management in Northern Ontario, Canada. Sociologia Ruralis 49(1):56-69.

Abstract

The purpose of this discussion is to provide a better understanding of the conflicting perceptions regarding cougar (*Puma concolor*) management in northern Ontario, Canada. Despite two alleged puma attacks, numerous cougar sightings throughout the region and the recent confirmation of the puma's existence in Ontario through DNA analysis, the existence of these animals in the north-east of Canada and the USA remains largely contentious. Findings derived from interviews conducted in northern Ontario and content analysis of media sources in Canada and the USA suggest that the ongoing debate over the existence of pumas in this region of Canada can be attributed to current wildlife management largely predicated on the grand narrative of the wildlife expert. This centralised, bureaucratic approach decreases the opportunity for constructive dialogue between stakeholders and mitigates the implementation of community-based wildlife management approaches. While this analysis largely focuses in Ontario, Canada, the debate provides insights into the human dimensions of wildlife management, especially elusive wildlife, in North America and elsewhere.

Leone, C.A. and A.L. Wiens. 1956. Comparative Serology of Carnivores. J. Mammal. 37:11-23.

SUMMARY

Serological comparisons were made of serum proteins from species representative of the seven families of fissipeds and one family of pinnipeds. The Felidae, in order of decreasing relationship as determined by comparative serological data is: Felidae-Viveridae, Hyaenidae, and Ursidae-Otariidae, Mustelidae, and Procyonidae-Canidae. The puma has a serum protein level of 6.93 grams/100cc as listed by the Serological Museum, Rutgers University. A table of serological relationships of some carnivores is provided, with values representing per cent of reaction between antigens and antisera. Antisera were produced against two species of Felids. The antisera against the serum proteins of the puma was weak.

Leopold, B.D. and P.R. Krausman. 1986. Diets of 3 Predators in Big Bend National Park, Texas. J. Wildl. Manage. 50(2):290-295.

Mountain lion (Felis concolor), bobcat (Felis rufus), and coyote (Canis latrans) scats were collected during 1972-74 and 1980-81 in Big Bend National Park, Texas. Mountain lions mainly consumed deer during 1972-74 and smaller prey during 1980-81. Bobcats consumed lagamorphs as their principal food source. Coyotes primarily ate insects, birds, reptiles, and lagamorphs. All three predators consumed more deer in 1972-74 than in 1980-81. We believe that the observed changes in the predator diets were due partially to a significant decline in the desert mule deer (Odocoileus hemionus crooki) population between the 2 sampling periods.

Leposky, G. 1975. Panther's Progress. Florida Wildlife 29(3):2-5.

Panthers were being observed near human habitation where they had never been known to occur. This led to the conclusion that perhaps protection from pursuit by man is the primary limiting factor rather than a need for wilderness seclusion. Biologists reported that convincing records of panthers in Florida during the previous 15 years were rare. Six records which were considered authentic are presented. In 1958, Florida invoked a total ban on panther hunting. It was suggested that disease and illegal hunting have held down the population despite almost two decades of complete protection.

Lesowski, J. 1963. Two Observations of Cougar Cannibalism. J. Mammal. 44:586

The author killed and skinned a cougar in December of 1960 in British Columbia and left the carcass. Seven days later the author killed a female cougar that had fed on the carcass for four or five days. In March of 1961, a large male killed and partially ate a smaller male in the same region. An account of the attack is presented. All of the cougars involved were in good physical condition and deer and moose were plentiful in the area.

Lester, T. and M. Kelly. 2007. Search for Cougars with Remote Cameras in the Southern Monongahela National Forest, West Virginia. Page 5 in Abstracts of Presentations of the 3rd Midwestern-Eastern Puma Conference, Trent University, Peterborough, Ontario.

Abstract

Twenty PhotoScout trail cameras were set in the southern part of the Monongahela National Forest between April and September in both years 2003 and 2004. Cameras were positioned along game trails and human trails. No visual or scent lures were used. Cameras stations were placed systematically by constructing a 5 km^2 grid system across the landscape and placing stations within each 5km^2 grid cell. Cameras were left in place for 1 month before being moved to new locations. To determine survey area we buffered each trap station with 1500 m radius circle and dissolved buffers between stations. We calculated % trap success as the number of animal photographs per 100 trap nights to standardize our capture rate. Our survey areas were 100.02 km^2 and 230.73 km^2 in 2003 and 2004 respectively. Total number of trap nights was 5410 (3062 in 2003 and in 2348 in 2004). While we did not have a confirmed eastern cougar photograph, we did "capture" 14 other species and 2 unknown animals which were not visible enough to confirm as eastern cougars. We photographed 919 animals in 2003 and 687 animals in 2004 for a total of 1606 photo captures across the 2 years. Overall trap success was nearly identical the across the two years at 29.7%. Trap success was highest for whitetailed deer (18.4%) followed by black bears (6.27%), coyotes (1.81%), bobcats (0.78%), and raccoons (0.74%). In other remote camera studies in areas known to have cougar populations, cougars have a 2-3 % trap success. No animals exhibited any particular pattern across the two, 6-month periods with the exception of bears which had low trap success in April, which then increased in later months. Other studies have also suggested that 1000 trap nights is sufficient to show that a population is not present in an area. Capturing animals that are dispersing into an area, however, may require more effort. We urge that other studies use standardized techniques for remote camera surveys and standardize for effort. In this way, information gained on other species can be useful as indicators of wildlife population status and range.

Lewis, J.C. 1968. Evidence of Mountain Lions in the Ozark, Boston, and Ouachita Mountains. Proc. Oklahoma Acad. Sci. 49:182-184.

Observation and specimens of cougar were tabulated to substantiate the existence of a small cougar population which was probably contiguous with the population in northwestern Louisiana. Observations were concentrated in eastern Oklahoma, western Arkansas, and southern Missouri.

Lewis, J.C. 1968. The Lion in Seven Mile Slough. Oklahoma Outdoors 24(7):16-17.

A cougar, killed by a .22 bullet, was found on April 13 by a fisherman in Seven Mile Slough adjacent to Eufaula Reservoir in McIntosh County. The adult female weighed an estimated 150 pounds with a tail 28 inches long. The skull and skeleton represented the first cougar found in Oklahoma in modern times. The last authenticated specimen in Oklahoma was reported taken in the late 1800's or early 1900's. A cougar was spotted near Canton Reservoir in western Oklahoma in 1953 and plaster casts were made of its tracks.

Lewis, J.C. 1969. Evidence of Mountain Lions in the Ozarks and Adjacent Areas, 1948-1968. J. Mammal. 50:371-372.

Young and Goldman (1946) reported that the last mountain lion known to have been taken in Oklahoma was obtained in 1852. In April, 1968, a fisherman found a carcass of a cougar in eastern Oklahoma, 10 mi. W Checotah, McIntosh County. The cougar was a yearling female weighing an estimated 150 pounds and having a tail 28 inches long. The skeleton was donated to the Oklahoma State University Museum. There were no records of any mountain lions escaping in this part of Oklahoma. The following observations were presented to substantiate the existence of a small population of mountain lions in this region. Between 1961 and 1965 sightings of cougar were repeatedly reported in Mayes, Craig, and Tulsa Counties in northeast Oklahoma (Daily Oklahoman, 12 issues). In Arkansas, a large male was taken near Mena in 1949 after it was treed by hounds; mountain lion or their sign were reported in 14 counties between 1949 and 1954 (Sealander 1956). A forester saw an adult and one cub near Shady Lake Recreation Area, Ouachita National Forest, in 1958. In 1962, the Chief of the Arkansas Game Division, saw a cougar in the Ozark National Forest, 25 miles N Russellville, Arkansas. The last mountain lion taken in Missouri was obtained in 1927 (Schwartz and Schwartz, 1959). In 1955, a conservation agent saw a cougar north of Shirley, Washington County (Robb, 1955), and in 1966 U.S. Forest Service employees saw two animals near Willow Springs, Missouri. In Louisiana, cougar tracks were observed in Nachitoches Parish in 1950 (St. Ament, 1959). A male cougar was shot near Keithville, Louisiana, in 1965 (Goertz and Abegg, 1966).

Lewis, P. 1976. The Mountain Lion. Colorado Outdoors 25(l):14-18.

A Colorado Division of Wildlife employee stationed at Spanish Peaks Wildlife Area was attacked by a mountain lion during the winter of 1973. An autopsy revealed that its esophagus was jammed full of porcupine quills. The Division of Wildlife estimated that there were 800 mountain lions inhabiting 40% of the state. The Division's overall management plan for mountain lions was to increase populations and sport hunting demand. Over the previous 10 years, less than 5% of the state's lion population had been harvested annually, which in 1974 amounted to 52 lions. A sport hunting permit system regulates the numbers and sexes of lions taken during the season which lasts about 200 days. All kills must be reported within 48 hours. Lion kittens and females with kittens may not be killed. Dogs (8 or less per party) may be used, but not during any open deer or elk season. It is illegal to trap mountain lions in Colorado. In 10 of 11 western states the mountain lion is classified as a game animal. General information on life history and general characteristics are also provided.

Lewison, R., E.L. Fitzhugh and S.P. Galentine. 2001. Validation of a Rigorous Track Classification Technique: Identifying Individual Mountain Lions. Biol. Cons. 99(3):313-321.

Abstract

Despite track survey efforts, the inability to identify individuals from survey data impedes accurate density estimates and density indices for large carnivore species. We present a track classification method for mountain lions *Puma concolor* using discriminant function analysis that improves and validates the method presented in Smallwood and Fitzhugh (1993) (Smallwood, K.S., Fitzhugh, E.L., 1993. A rigorous technique for identifying individual mountain lions *Felis concolor* by their tracks. Biological Conservation 65, 51–59) and further discussed in Grigione, Burman, Bleich and Pierce, 1999 (Grigione, M.M., Burman, P., Bleich, V.C., Pierce, B.M., 1999. Identifying individual mountain lions *Felis concolor* by their tracks: refinement of an innovative technique. Biological Conservation 88, 25–32). Artificial tracks, made from molded casts of the feet of 13 lions, were used to simulate variability from field conditions in a controlled laboratory setting. We tested the effects of multiple track recorders and two soil depths on linear and angular measurements of the entire paw and shape measurements of the heel-pad. We identified six track measurements that correctly matched 96% of track tracings to known individual mountain lions, even with variability from multiple track recorders and soil depths. Model validation, performed on lab and novel field data in which the number of individual mountain lions was unknown, illustrates the efficacy of the method. Following the field-based study by Smallwood and Fitzhugh (1993), this study provides support for the utility of the discriminant analysis method for track data and outlines future application of this method to field data.

Li, X., H. Steinberg, C. Wallace, F.A. Kallfelz, R. Johnson, W.I. Anderson and R.M. Lewis. 1992. Functional Thyroid Follicular Adenocarcinoma in a Captive Mountain Lion (Felis concolor). Vet. Pathol. 29(6):549-551.

This report describes a functional adenocarcinoma of thyroid follicular origin with clinical hyperthyroidism and recurrence in an intact 12-year-old female mountain lion.

Likens, D.D. 2005. Cougar Capture Methodologies, Documented Results, and Capture Event Behavioral Trends: From a Team of Hound-Science Volunteers Supporting Key Pacific Northwest Wildlife Research Projects. Page 215 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

This presentation depicts the Hound-Science team's cougar capture event results during more than 300 man-days of volunteer effort from March 2002 thru December 2004. The team provided hound capture services for state Fish & Wildlife Departments' research projects in southwest Oregon and central Washington. Day to day hunting conditions, depending on season, ranged from dry ground, to periods of light and heavy precipitation, to deep snow. Hounds were deployed using various transportation methods including motor vehicles (pickups), snowmobiles, and on foot handlers. From 51 tracks started, a total of 47 cougar were treed of which 29 were sedated. Thirteen, of those sedated, immediately jumped from the tree after injection (8 female, 5 male). All 13 were located on foot by Hound-Science team members using a single leashed hound. The poster will visualize hound-science capture methods, will correlate capture event results with

the level of effort required, and will attempt to show cougar behavioral patterns associated with capture events. The presentation is intended to provide information for enhancing project safety and efficiency by wildlife management personnel either involved in or planning for cougar research. It will also provide general information for others interested in the species.

Lindzey, F.G. 1983. Procedure for Estimating Mountain Lion Allowable Harvest for Maximum Sustained Yield. Utah Div. Wildl. Resources Research Memo. 2pp.

Begin by estimating total cougar habitat in the unit and then apply the cougar density estimate to cougar habitat to arrive at total cougar population per unit figure. Multiply total estimated unit population by 70% to remove legally-protected cubs and arrive at harvestable population estimate. Multiply harvestable population by 20% to arrive at "allowable kill" figure for the unit.

Lindzey, F.G. 1987. Mountain Lion. Pgs. 657-668 In: Novak, M., J.A. Baker, M.E. Obbard, and B. Malloch (eds.), Wild Furbearer Management and Conservation in North America. Ontario Trappers Association, Ontario Ministry of Natural Resources.

Information on the mountain lion, including description, distribution, life history, ecology, food habits, behavior, management, and conclusions are provided.

Lindzey, F.G., B.B. Ackerman, D. Barnhurst, and T.P. Hemker. 1988. Survival Rates of Mountain Lions in Southern Utah. J. Wildl. Manage. 52(4):664-667.

We monitored survival of resident mountain lions (Felis concolor) during a radio-telemetry study between 1980 and 1986 in southern Utah. Yearly survival of resident adults ranged from 52 to 100% (mean = 74%). Causes of death included intraspecific killing, injury related to prey capture, trapping, and starvation. Deaths of dispersing offspring were human-related.

Lindzey, F.G., and W. VanSickle. 1988. Mountain Lion Population Dynamics (Utah). Pg. 56 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.

Dynamics of a southern Utah mountain lion population were monitored from 1979 to 1986 when we removed 30% of the population. Resident numbers remained relatively stationary in this unhunted population and yearly survival of residents averaged 74%. Census techniques are currently being evaluated and the population monitored to document the influence of the removal which was done to simulate sport hunting loss.

Lindzey, F.G., B.B. Ackerman, D. Barnhurst, T. Becker, T.P. Hemker, S.P. Laing, C. Mecham, and W.D. VanSickle. 1989. Boulder-Escalante Cougar Project. Final Report. Utah Div. Wildl. Resources. 92pp.

This report synthesizes results from the study since its inception in 1978 to May 1989. The 4,500 km^2 study area was located in the Canaan, Escalante, and Boulder Mountains and associated canyonlands of Garfield and Kane counties in south-central Utah. Seventy-two radiocollared cougars were monitored an average of 16.9 months (s.d. 17.3) during the term of the project. Thirty-one litters were observed with an average litter size of 2.4 (n=26). The average age at first breeding of females that were marked as kittens and stayed on the study area was 23 (s.d. 4.5) months. The interval between successive litters (n=7) had a mean length of 24.3 months (s.d. 6.8) with the shortest at 19 months and the greatest 40 months. Radio-collared mountain lions were monitored for 17-1,825 days (x=821 days). The survival of kittens first observed at or before 4 months of age (n=10) until 10 months was 72%; of 13 kittens between 10 months of age and dispersal (16-19 months) was 92%; of 18 kittens in 8 litters monitored from contact to dispersal was 67%. Adult male (> 2 years) home ranges overlapped each other an average of 33.3% (s.d. 31.24). Resident female home ranges (n=19) shared 84.8% (s.d. 22.2) of their range with neighboring female residents. Females acquired most of their total home ranges during their first year of independence and establishment. Resident female offspring commonly replaced deceased resident females. Seven species were represented in the kill sample (112 kills examined): Mule deer accounted

for 88% and elk 4%. Domestic cows, coyote, and jack rabbits were also found. Badger remains were found in the stomach of a kitten. Three instances of cannibalism were observed. Three-hundred and sixteen prey items were detected in 239 scats. Mule deer comprised 61% of items detected, but occurred in 80% of all scats. Cougars consumed an average of 73.5% + or - 4.2% by weight of each carcass. Cougar energetics was investigated and a cougar energetics simulation model was described in detail. Seventy-five cougar-killed deer were classified as part of the cougar-mule deer interactive study (19 adult males, 31 adult females, and 25 fawns). Cougars apparently killed deer above the age of 7 years out of proportion to their abundance in the population, and conversely, prime-aged adult deer were killed less frequently than expected. Cougar predation was found to be an important cause of annual adult mortality (female 41%, male 35%), although only a minor (6%) cause of fawn mortality. These results probably over-estimate the impact of cougar predation on the deer herd. A total of 3,580 telemetry locations on 52 individual cougars were assigned habitat types. Of these, 568 (15.9%) were located in sandstone ledges interspersed with pinyon pine and Utah juniper, 556 (15.5%) in ponderosa pine mixed with gambel oak, 488 (13.6%) in mixed pinyon pine and Utah juniper woodlands with lava rock boulders, and 394 (11.0%) in spruce-fir. Highly used habitats characteristically occurred at higher elevations and on steeper slopes, had denser overstory and understory cover, taller overstory heights, less horizontal visibility, more large trees present, were closer to roads and distal terrain, and were farther from ecotones in comparison to avoided habitats. A habitat model is presented and discussed. The vulnerability of cougars to hunting and the interpretation of harvest data are discussed in detail. The removal experiment (simulated harvest) was able to sustain a 30% removal of its members and other losses and recover numerically within a year. Recovery, however, was possible because of the immigration of transients into the population and the presence of female offspring > 1 year of age. A small number of cougars were transplanted or released (n=9) on the study area. Results suggested that young cougars of both sexes (transient age class) can probably be transplanted relatively short distances with a good probability that they will not return. Resident, adult males are probably the least suitable candidate. Adult females may not return if moved great enough distances (i.e. > 75km) and may establish new ranges and contribute to the population of the area into which they are moved. Moving cougars into areas that are already occupied by cougars of the same sex carries with it the risk that the transplanted cougar will be killed if it does not move. It appears feasible to maintain orphaned kittens in a cage and release them at an age that provides some opportunity for their survival (> 6 months). Kittens that eventually accept humans should not be released. Management suggestions are presented.

Lindzey, F.G. 1991. Managing Lions in a Changing Social Environment. Pgs. 81-82 In: Mountain Lion-Human Interaction Symposium, C.E. Braun (ed.), Col. Div. Wildl., Denver. 114pp.

Managing wildlife populations solely to reduce livestock losses and to provide huntable surpluses will end, and hunting as a management tool will probably receive increasing scrutiny. The best management will be a reduction of the probability of encounters between mountain lions and humans. Frequency of attacks may be explained partially by the density of humans and the density of mountain lions in an area and it is expedient to begin building management of mountain lions on the premise of a density-encounter relation. Reducing natural prey in and around areas of human development should reduce the likelihood of mountain lions remaining. Reductions of prey animals can either be direct or indirect by altering vegetation in a manner which makes it less acceptable to prey animals. Presumably, reducing densities in prescribed areas not only reduces the number of dispersing young near developments, but these areas may also function as sinks that short-stop dispersing mountain lions from other areas. A combination of many approaches rather than a single approach may resolve the problem.

Lindzey, F.G., W.D. Van Sickle, S.P. Laing, and C.S. Mecham. 1992. Cougar Population Response to Manipulation in Southern Utah. Wildlife Society Bulletin 20:224-227.

SUMMARY

A cougar population in southern Utah did not recover in 9 months from the experimental removal of 27% of its harvest-age (> 1-year-old) members. The adult resident segment, with the possible exception of 1 male, recovered through replacement by transients and female offspring of the population. This recovery included the replacement of 2 other adult resident cougars that died during the year. Failure of the population to recover to preremoval level 2 years later, and its inability to replace 1 of 3 adult residents that died the second year, suggest that the population would not have recovered as quickly from a second year's harvest of similar intensity. The effect of hunting on cougar populations will depend both on the level of harvest and sex and age of cougars removed; populations will be most sensitive to loss of adult resident

females. Losses to hunting will not be totally compensated for by a reduction in other deaths normally incurred by cougar populations.

Lindzey, F.G., W.D. Van Sickle, B.B. Ackerman, D. Barnhurst, T.P. Hemker, and S.P. Laing. 1994. Cougar Population Dynamics in Southern Utah. J. Wildl. Manage. 58(4):619-624.

We monitored size and composition of a southern Utah cougar (Felis concolor) population during 1979-87 to document the dynamics of this unhunted population and to test the hypothesis that cougars would regulate their density at a level below that set by prey abundance alone (Seidensticker et al. 1973). We captured cougars when detected during ongoing searches for sign in the study area. Resident adult cougar density remained relatively constant (0.37/100 km^2) for the first 7 years but increased slightly in the last 2 years. Mule deer (Odocoileus hemionus), the cougar's primary prey, increased over the 9 years, but magnitude of this increase was unknown. Results supported the hypothesis that cougar density is set by environmental features other than prey abundance alone. Adult resident females bred as young as 17 months and produced litters that averaged 2.4 kittens at an interval of 24.3 months.

Linnell, J.D.C., J. Odden and R. Andersen. 2003. Ecology and Management of the “European Mountain Lion” (Lynx lynx). Page 70 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

In a world of limited research funds it is important to make use of all existing data when making management decisions for large carnivores such as mountain lions (Puma concolor). Transferring data and experience from other species with a similar ecology is a possible approach of efficiently using resources. Our goal in this paper is to argue that Eurasian lynx (Lynx lynx) are such a species, and that much of the research and management experience associated with lynx in Europe may be relevant for mountain lion management. Eurasian lynx have been intensively studied throughout western Europe during the last 15 years. Telemetry based projects have been run in Norway, Sweden, Switzerland, Poland, France, Slovenia, Romania and the Czech Republic. Unlike Canadian lynx (Lynx canadensis), the Eurasian lynx feed mainly on ungulate prey (roe deer, red deer, reindeer) in western Europe. Intra-sexual territoriality has been observed in all populations of Eurasian lynx that have been studied using telemetry so far. Home range / territory sizes vary in size from 50-1,000 km^2 for females and 100-1,500 km^2 for males, mainly depending on prey density. Dispersal distances have been observed up to 450 km. These results are very similar to mountain lions, however there is one major difference, cases of intra-specific killing are virtually unknown among Eurasian lynx. Eurasian lynx currently face a range of management issues, ranging from enormous conflicts with livestock, through management discussions about regulating hunter harvest and establishing monitoring programs, to reintroduction and translocation projects. International cooperation in research, conservation and management is very good. Therefore, there are many ecological and management parallels between Eurasian lynx and mountain lions where the potential for information transfer exists.

Litchfield, L. 1993. Panthers in Peril. Zoo Life 4(2):42-47.

After man, pumas are probably the most widespread large mammal in the Western Hemisphere. Thirty to fifty Florida panthers still roam in the Big Cypress National Preserve and the Florida Panther National Wildlife Refuge that lies in the shrinking corridor between the fast-growing urban areas of Fort Lauderdale/Miami on the east coast and Naples on the west. Male panthers may need territories as large as 250-400 square miles in which to hunt deer, wild hogs, armadillos, raccoons and even alligator. Road kills have been the major cause of panther deaths. Since 1989 mercury poisoning, possibly from the increasing use of incinerators on the coasts, has likely contributed to the deaths of several cats in the Everglades. Two of the subspecies characteristics, a kink at the end of the tail and a cowlick in the middle of the back, are now believed to be the result of inbreeding. An increasing number of males have demonstrated cryptorchidism (one testicle fails to descend) and the males sperm is more than 90% defective. In addition, heart murmurs have been detected in the kittens and many adults. A total of twenty-two radio-collared panthers are currently being monitored. The future of the Florida panther now depends on a captive breeding program. A Species Survival Plan aims to have a breeding population of 130 animals by the year 2000 and 500 by 2010. This will be possible only with the aid of hi-tech methods such as artificial insemination and in vitro fertilization, possibly in surrogate mothers. Another possibility involves genetic contributions from Texas cougars. It has been proven with DNA analysis that at least some of Florida's cougars in the

Everglades have genes from a Latin American subspecies, probably from cats released by private owners in the 1950's and 1960's. Six kittens were removed from the wild and taken to White Oak Plantation at Yulee, Florida in 1991 to start the captive breeding program. As of November 1992, only four kittens had been taken, split up between White Oak, Jacksonville Zoo and Lowry Park Zoo in Tampa, Florida. In 1989 the 30,000-acre Florida Panther National Wildlife Refuge was established next to Big Cypress. In addition, speed limits on roads crossing panther country are being more strictly enforced, fences have been erected along the highways to help prevent road kills and 36 new underpasses provide safer wildlife crossings.

Loft, E.R. 1997. Spatial-Temporal Analyses of Mountain Lions in the Sierra Nevada: Looking for Patterns and "Bulls-Eyes" Amid the Mess. Page 87 *in* W.D. Padley, ed., Proc. Fifth Mountain Lion Workshop: 27 February- 1 March 1996; San Diego, California.

From 1983-1992, the California Department of Fish and Game and the U.S. Forest Service Pacific Southwest Research Station conducted a telemetry study of mountain lions in the Sierra Nevada to learn more about their habits and impacts on mule deer of the North Kings Deer Herd. Data on 30 animals (11 male, 19 female) were used to examine home range (95% adaptive kernel estimate), elevational change, and spatial-temporal relationships. Over 8,500 radio locations were used in analyses. Mean home range size for males during winter and summer was 139 and 176 sq. mi., respectively. Female home ranges averaged 63 and 117 sq. mi. Most lions moved up/down in elevation seasonally, while some maintained home ranges at low elevations. In summer, lion density over years ranged from 1.2-2.0 lions/100 sq. mi.; during winter, density ranged from 1.4-3.0 lions/100 sq. mi. Spatial overlap was highest among females (mean = 32%), intermediate between the sexes (mean = 31%), and lowest among males (mean = 23%). Overlap of kittens with non-mother adults was also examined. Kitten home ranges overlapped more with adult males in summer (mean = 43%) than with females (mean = 27%). Initial results of spatial-temporal relationships among lions will be presented. As an example, each male overlapped with about 85 percent of males known to be present in summer, and 94 percent of males in winter.

Logan, K.A. 1983. Mountain Lion Population and Habitat Characteristics in the Big Horn Mountains of Wyoming. M.S. Thesis. Univ. of Wyoming, Laramie. 114pp.

A mountain lion (Felis concolor) population was studied from June 1981 to July 1983 in a 741 square kilometer area in the Big Horn Mountains, Wyoming. Population characteristics and spatial distribution were determined using capture-recapture, snow-tracking, and radio-relocation data. Estimated population density for the 1981-82 winter was 29 km^2/lion, and 22 km^2/lion the 1982-83 winter. The population was composed of resident adults, transient adults, and juveniles (kittens). There were 2 to 3 times more resident females than resident males. Twice as many transient males as transient females were observed. The adult male:female sex ratio was 45:55. Thirteen kittens were raised on the study area the first year, and 17 the second year. An autumn birth peak was observed. Sex ratio of kittens was 39:61. Juveniles apparently dispersed from the study area after reaching independence. Two resident females had unusually short breeding intervals at 13 and 19 months. The age structure was young; the oldest adult being about 7 years old. Observed mortality the first year was 27% of the population, and 3% th second year. A history of harvest mortality since 1976 and the observed age structure suggested recruitment of transient lions adequately compensated for the mortalities. Home areas of two resident male lions overlapped slightly or not at all, and averaged 320 km^2 in size. Home areas of four resident females overlapped other female home areas extensively, and averaged 67 km^2. Male home areas overlapped several female home areas. Ecological implications in management are discussed. Characteristics of habitats used by mountain lions was determined by describing habitat features at 191 track locations, 118 radio-relocations, 52 cache sites, and 84 scratch sites. Lions preferred mixed conifer and curlleaf mountain mahogany vegetation types and steep and very steep topography. Douglas-fir, Juniper/sagebrush-grass, lodgepole pine, and riparian types and moderate topography were used in proportion to availability. The sagebrush-grass type and gentle topography was avoided. Mean seasonal elevations of lion locations were statistically different. Most cache sites were in the curlleaf mountain mahogany type (32.7%), followed by the mixed conifer type (25.0%), and the Juniper/sagebrush-grass type (21.15%). Scratch sites were primarily in the mixed conifer type (79.8%). Lions preferred habitats associated with canyonlands featuring shrub or tree cover, high relief, and abundant prey. Seasonal movements of mule deer (Odocoileus hemionus) appeared to influence elevational shifts in lion habitat use. Habitats that attracted lions appeared to be important for prey acquisition and consumption, security, and intrasocial communication. Implications in management are discussed briefly.

Logan, K.A. and L.L. Irwin. 1984. Mountain Lion Population and Habitat Characteristics in the Bighorn Mountains,

Wyoming. Pgs. 189-190 In: J. Roberson and F. Lindzey (eds.), Proc. of the Second Mountain Lion Workshop. Utah Div. Wildl. Res. and Utah Coop. Wildl. Res. Unit. Zion National Park. 271pp.

SUMMARY

A mountain lion (Felis concolor) population was studied year-round from June 1981 to July 1983 in a 741 km^2 (286 mi^2) area in the Bighorn Mountains, Wyoming. Population characteristics were determined using capture-recapture, harvest, snow-tracking, and radiolocation data. Forty-six lions were captured 104 times in the 2 winters of the study. Estimated population density for the 1981-82 winter was 29 km^2/lion 911 mi^2/lion), and 22 km^2/lion (8 mi^2/lion) for the 1982-83 winter. The population was composed of resident adults, transient adults, and juveniles (kittens). There were 2 to 3 times more resident females than resident males. Twice as many transient males as transient females were observed. The adult male:female sex ratio was 45:55. Thirteen kittens were raised on the study area the first year, and 17 the second year. An autumn birth peak was observed. The sex ratio of the kittens was 39:61. Juvenile dispersal after independence was observed in 3 males 15 to 20 months of age which were captured about 60 km (37 mi), 1983 km (120 mi), and 274 km (170 mi) from their natal areas. Two resident females had breeding intervals at 13 and 19 months. The age structure was young; the oldest adult being about 7 years old. Observed mortality the first year was 27% of the population, and 0% the second year. A history of harvest mortality since 1976 and the observed age structure during the study suggested recruitment of transient lions adequately compensated for the mortalities. Home areas of 2 resident male lions overlapped slightly or not at all, and averaged 320 km^2 (124 mi^2) in size. Home areas of 4 resident females overlapped other female home areas extensively, and averaged 67 km^2 (26mi^2). Male home areas overlapped several female home areas. Habitat use by mountain lions was determined by describing habitat features at 191 track locations, 118 radio-locations, 52 cache sites, and 84 scratch sites. Lions preferred mixed conifer and curlleaf mountainmahogany vegetation types and steep and rugged topography (>50% slope). Douglas-fir, juniper/sagebrush-grass, lodgepole pine, and riparian types and moderate topography (20-40% slope) were used in proportion to availability. The sagebrush-grass type and gentle topography (<20% slope) was avoided. Most cache sites were in the curlleaf mountainmahogany type (32.7%), followed by the mixed conifer type (25.0%), and the juniper/sagebrush-grass type (21.15%). Scratch sites were primarily in the mixed conifer type (79.8%). Mean seasonal elevations of lion locations were statistically different. Elevational shifts in lion habitat use appeared to be influenced by seasonal movements of mule deer (Odocoileus hemionus). Lions preferred habitats associated with canyon-lands featuring shrub or tree cover, high relief, and abundant prey. Habitats that attracted lions appeared to be important for prey acquisition and consumption, security, and intra-social communication.

Logan, K.A. and L.L. Irwin. 1985. Mountain Lion Habitats in the Big Horn Mountains,Wyoming. Wildl. Soc. Bull. 13:257-262.

SUMMARY

Mountain lion habitat use patterns were determined by describing habitat features at 191 track locations, 118 radiolocations, 52 cache sites, and 84 scratch sites. Lions preferred mixed conifer and curlleaf mountainmahogany vegetation and steep and rugged topography (>50% slope). Douglas-fir, juniper/sagebrush-grass, lodgepole pine, and riparian zones and moderate topography (20-40% slope) were used at random. Sagebrush-grasslands and gentle topography (<20% slope) were avoided. Most cache sites (32.7%) were in curlleaf mountainmahogany and most scratch sites (79.8%) were in mixed conifer. Lions apparently selected those habitats that provided vegetative or topographic cover which conferred advantages while hunting. Management implications address large-scale changes in habitat, estimating lion population densities in similar habitat and reducing predation on domestic livestock.

Logan, K.A., L.L. Irwin, and R. Skinner. 1986. Characteristics of a Hunted Mountain Lion Population in Wyoming. J. Wildl. Manage. 50(4):648-654.

Population characteristics were estimated from June 1981 to July 1983 for a hunted mountain lion (Felis concolor) population occupying a 741km^2 study area in the Big Horn Mountains, Wyoming. Based on the capture-recapture of 46 lions and radio-telemetry, snow-tracking, and harvest data, winter population densities were estimated at 29 km^2/lion (1981-82) and 22 km^2/lion (1982-83). Sex ratios of 28 kittens and 22 adults did not differ ($P<0.05$) from equality. Kittens, born primarily in autumn, comprised about 50% of the population each winter, and 11 postnatal litters averaged 2.7 kittens. Some juveniles dispersed at about 12-16 months of age; 5 were recovered 9-274 km from their natal areas. Two

resident females bred at 13- and 19-month intervals. The age structure of both sexes was young, the oldest adult being about 7 years old. Observed mortality the first year was 27% of the total population and 0% the 2nd year; immigration apparently compensated for mortalities. Home areas of 4 resident females averaged 67 km^2 and overlapped almost completely. Those of the 2 resident males overlapped slightly and averaged 320 km^2. Male home areas overlapped several female home areas.

Logan, K.A., E.T. Thorne, L.L. Irwin, and R. Skinner. 1986. Immobilizing Wild Mountain Lions (Felis concolor) with Ketamine Hydrochloride and Xylazine Hydrochloride. J. Wildl. Dis. 22(1):97-103.

A mixture of 120 mg ketamine hydrochloride (KHCL)/20 mg xylazine hydrochloride (XHCL)/ml was used to immobilize 37 wild mountain lions (Felis concolor) 46 times. Observations were recorded during 37 trials that included kittens, adult females, and adult males. Dosages were based on 11 mg KHCL and 1.8 mg XHCL/kg estimated body weight. Actual dosages for 24 lions requiring a single injection for immobilization ranged from 4.7-15.8 mg KHCL/kg and 0.8-2.6 mg XHCL/kg. Induction, duration, and recovery times did not differ ($p<0.05$) between the sex and age classes. Two kittens were overdosed with the drug combination, but the effects were not life threatening. Eleven other lions, nine of which were initially underdosed, required additional injections of the drug combination for safe handling. Immobilization was characterized initially by semi-consciousness, open eyelids, pupillary dilation, and muscle rigidity. Later, most lions appeared unconscious, muscles relaxed, and breathing slowed considerably. No convulsions or hypersalivation occurred. The KHCL/XHCL mixture given at approximately 11 mg KHCL and 1.8 mg XHCL/kg body weight proved useful for immobilizing wild mountain lions for research purposes. Suggestions for care of immobilized cats are included.

Logan, K.A., L.L. Sweanor, J.F. Smith, B.R. Spreadbury, and M.G. Hornocker. 1988. Ecology of an Unexploited Cougar Population in a Desert Environment. Pg. 77 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.

We are currently beginning the fourth year of a 5 year study on the ecology of an unexploited population of cougars in the San Andres Mountains of south-central New Mexico. The objectives are: (1) to determine cougar population dynamics, (2) to determine the distribution and movements of radio-collared cougars, and (3) to determine the effects of cougar predation on unhunted populations of desert mule deer and desert bighorn sheep. During the past 39 months of research, we have captured, marked, and released 57 cougars. Thirty-four cougars (17 females, 17 males) have been monitored by radio-telemetry. Eight females have produced 10 litters for a total of 29 progeny. Mortality has been documented for 7 adults (6 females, 1 male), 1 subadult male, and 6 progeny (2 females, 4 males). We have documented mortalities of 162 prey animals. Desert mule deer population dynamics are being monitored by the New Mexico Department of Game and Fish through biannual helicopter surveys, radio-telemetry, and computer modeling. Desert bighorn sheep population dynamics are being monitored by the U.S. Fish and Wildlife Service through ground surveys and radio-telemetry

Logan, K.A., L.L. Sweanor, J.F. Smith, B.R. Spreadbury, and M.G. Hornocker. 1990. Ecology of an Unexploited Mountain Lion Population in a Desert Environment. Annual Rep., Proj. No. W-128-R-5, Job 1. New Mexico Dept. of Game and Fish, Santa Fe. 141pp

A total of 97 lions were captured, marked, and released during 59 months of research. During years 3-5, the entire population ranged from 43 to 65 lions. During years 2-5, juveniles and subadults (less than or equal to 1.5 years old) comprised 30.2% to 51.6% of the population. Lions of breeding age (greater than or equal to 2 years old) comprised 48.4% to 69.8% of the population. No significant differences were observed between sex ratios of 1:1. Twenty-five litters born to 18 females for a total of 66 progeny were documented. The mean size of 18 litters comprised of 53 kittens less than or equal to 5 weeks old was 2.9 kittens/litter. The mean interbirth interval (birth date to birth date) was 16.7 months for 6 females that successfully raised litters. Most births (11 litters) occurred during September through November. Although most females were greater than 2 years old (82%) when they produced kittens, three females bred when they were about 15-20 months old. Breeding pairs associated for up to four days with an estimated mean gestation period of 90.9 days for 11 live litters. Thirty-three lions died or disappeared from the population during the 59 months. Intraspecific strife was the most important cause of documented mortality in this unexploited population among adults and subadults. Cannibalism was the most important documented cause of mortality among juveniles. During years 2-5, twenty-two probable immigrants were counted for an immigration rate of about 5.5 lions/year. Of 9 progeny surviving to independence, eight became independent from their mothers when they were 11 to 18 months old. Of the 66 progeny

produced on the study area, 22 have died, 4 became residents, 1 was translocated, and up to 21 were still dependent on mothers. The density of the total lion population ranged from 1.7 to 3.3 lions/100 km^2 (4.4 to 8.5 lions/100 mi^2). The density of resident adults ranged from 0.9 to 1.5 lions/100 km^2 (2.3 to 3.9 lions/100 mi^2). A total of 50 lions (30 females, 20 males) were radiocollared and located over 5000 times. Nine and possibly 11 species of mammals, involving 234 individuals were utilized as food by lions. Mule deer comprised by far the largest percentage (204) of the sample. Eight incidences of scavenging on the carcasses of ungulates were documented. Lions killed male mule deer significantly greater than their availability and females were killed less than their availability. More lion-caused deaths of mule deer occurred in winter than any other season. Lions killed male and female bighorns in proportion to their availability in the population. During 54 months (Sept. 1980-Feb. 1985) 41 lions were killed for control purposes and to protect bighorn populations for sport hunting in the San Andres Mountains. The lion was protected for the 63 month period from March 1985 to June 1990, which included this lion study. During the study, 33 lion deaths were documented.

Logan, K., L. Sweanor and M. Hornocker. 1996. Cougar Population Dynamics. Chapter 3 In: Cougars in the San Andres Mountains, New Mexico. Project No. W-128-R, Final Report, New Mexico Dept. Game and Fish, Santa Fe. 290pp.

We studied cougar population dynamics on the 2,059 km^2 San Andres Mountains (SAM), New Mexico from August 1985 to March 1995. The study area was divided into a 703 km^2 treatment area (TA) and a 1,356 km^2 reference area (RA). We counted a total of 294 cougars, of which we captured and marked 241. Radio-collars were put on 126 cougars. We recorded a total of 13,947 cougar locations. The cougar population was comprised of adults, subadults, and cubs; each age class comprised on average 0.58, 0.07, and 0.35 of the population. The oldest male and female cougars were about 152 months and 146 months, respectively. The sex structure of adults and subadults favored females; however, the ratios were not significantly different from 1:1 (P greater than 0.10). Cubs had a 1:1 sex ratio. Cubs were born in every month, except February. A birth pulse occurred during July to September and coincided with the mule deer fawning season. Litters averaged 3.02 cubs for litters that were 9 to 49 days old. Gestation periods averaged 91.3 days. Birth intervals averaged 17.4 months when greater than or equal to 1 cub survived to independence or to 12 months. Females associated with adult males for the first time at an age of 21.4 months old, and males associated with adult females for the first time at a mean age of 24.3 months old. Females conceived for the first time and bore their first litter at mean ages of 26.1 months and 29.1 months, respectively. Reproductive females bore 1 to 5 litters each. Twenty-six percent of the adult females produced 50% of the cubs and 71% of the recruits. Thirty-eight percent of breeding males were related to greater than or equal to 45% of the progeny on the SAM, and greater than or equal to 50% of the recruits. Cubs had a maximum finite rate of survival of 0.68. Natural rates of survival were estimated by a maximum finite rate (cFRS) and the change in the mean number of cubs per litter (CN), which yielded rates of 0.71 and 0.73, respectively. Infanticide and cannibalism by male cougars was the greatest single cause of death in cubs (44%). Other causes included, starvation (37%), disease (11%), falls (4%), and coyote predation (4%). Subadult males and females had survival rates of 0.56 and 0.88, respectively. All subadults that died were killed by male cougars. Mean annual survival rates for adult males and adult females were 0.90 and 0.81, respectively. Intra-species strife was the single greatest cause of mortality in adult cougars (50% of male deaths and 53% of female deaths). Other causes were attributed to disease (17%), accidents (10%), old age (10%), snake bite (3%), and unknown (7%). Offspring became independent from mothers at an average of 13.4 months. Those that dispersed left their natal areas at an average age of 15.6 months. All males dispersed from their natal areas and most emigrated from the SAM altogether. Males dispersed an average distance of 101.3 km to their independent home ranges, and females dispersed an average distance of 28.3 km to their independent home ranges. Dispersing cougars reached habitats in southern New Mexico within a 196 km radius of the SAM. Other females were philopatric. Of the progeny that survived to adult age, about 83% of males emigrated and about 59% of females emigrated. The emigration rate from the SAM was about 3.8 males and 4.8 females per year. The rate of recruitment was about 3.6 males and 4.9 females per year. On the TA, we experimentally reduced the adult cougars by 53% and independent cougars (adults + subadults) by 58% during December 1990 to June 1991. It took 31 months for the adult segment of the population to recover to the pre-treatment level. The replacement adults reoccupied the TA at the same sex ratio as before the treatment. The cougar population on the SAM increased during the study as it recovered from effects of sport-hunting and control from 1979 to 1985. Density of adults estimated each January on the TA increased from 1.16 to 2.10 cougars/100 km^2 in the pre-treatment years (1988-1991) and from 0.84 to 1.99 cougars/100 km^2 in the post-treatment years (1992-1995). In the RA, January adult cougar densities increased from 0.94 to 2.01 cougars/100 km^2 during 1989 to 1995. Observed exponential rates of increase (r) for adult cougars (using January estimates) in the TA during the pre-treatment and post-treatment years were 0.21 and 0.28, respectively. In the RA, the r was 0.11 for the years 1989 to 1995. When we calculated r for the RA in 4-year span similar to the TA, the r for 1989 to 1992 was 0.17 and the r for 1992 to 1995 was 0.05. This suggested a density dependent rate of increase. Gender-specific rates of increase indicated that

adult females generally increased at higher rates than adult males. Observed exponential rates of increase calculated from annual adult density estimates produced similar patterns in r. We thoroughly discuss our findings in relation to studies of other cougar populations in North America. Management implications are provided.

Logan, K., L. Sweanor and M. Hornocker. 1996. Cougars and Desert Mule Deer. Chapter 5 In: Cougars in the San Andres Mountains, New Mexico. Project No. W-128-R, Final Report, New Mexico Dept. Game and Fish, Santa Fe.

We studied the relationships between cougars, desert mule deer, and precipitation on the San Andres Mountains (SAM), New Mexico from 1985-1995. Experimental removal of cougars from a 703 km^2 treatment area (TA) within the SAM allowed us to examine the effects of cougar predation on deer over a range of cougar densities. Densities of adult cougars on the TA during the pre-treatment span (1987-1990) increased from 1.17 to 2.01 cougars/yr./100 km^2. After reducing the number of adult cougars by 53% and the number of independent cougars by 58%, the density of adult cougars increased during the post-treatment span (1991-1994) from 1.09 to 1.87 cougars/yr./100 km^2. Mule deer comprised 84% average annual frequency of occurrence in cougar feces and 91% of animals we found killed by cougars. Cougars apparently did not select for either gender. Fawns comprised about 27% of the cougar-killed deer we found by chance. We documented 15 cases of scavenging by cougars. Deer population composition surveys showed declining trends in fawn:doe ratios during the pre-treatment (52-36 fawns:100 does) and post-treatment (41-7 fawns:100 does) spans. We calculated survival rates and cause-specific mortality rates for 175 radio-collared mule deer. During the pre-treatment span, survival rates for radio-collared deer were generally stable. Average annual survival rates for bucks (0.876) and does (0.883) were practically equivalent, and span survival rates did not differ significantly (0.583 and 0.606 for bucks and does, respectively). However, survival rates for radio-collared deer during the post-treatment period declined and were significantly lower than in the pre-treatment span (P less than 0.02). The average annual survival rate for bucks (0.662) was lower than for does (0.787), and span survival rates were significantly different (0.172 and 0.370 for bucks and does, respectively; P=0.01). Cougar predation rates on radio-collared deer during the pre-treatment span were generally stable, averaging 0.066 per year; and mortality rates from other causes of mortality were not significantly different, averaging 0.056 per year. But cougar predation rates on radio-collared deer increased significantly (P less than 0.001) during the post-treatment span, averaging 0.226 per year. Mortality rates from other causes of mortality were essentially the same as before, averaging 0.054 per year. Precipitation accumulations during the growing season (July-Sep.) and habitat conditions that we observed indicated that severe drought conditions struck the SAM during 1992-1995. Linear regression analyses using deer survival rates, deer mortality rates, cougar predation rates, and fawn:doe ratios as the dependent variables; and adult cougar density, growing season precipitation, and annual precipitation as the independent variables, helped to explain relationships between cougars, deer, and habitat conditions (as indexed by precipitation). We concluded that the deer population was either stable or increasing when the deer population was below ecological carrying capacity (during 1987-1990). But, when the deer population exceeded carrying capacity because of the drought, fawn production declined drastically and deer were more vulnerable to cougars. During the drought, cougar predation was the major proximate source of mortality which helped to drive the deer population downward. But habitat condition (quantity and quality) was the ultimate limiting factor. Management implications are provided.

Logan, K., L. Sweanor and M. Hornocker. 1996. Cougars and Desert Bighorn Sheep. Chapter 6 In: Cougars in the San Andres Mountains, New Mexico. Project No. W-128-R, Final Report, New Mexico Dept. Game and Fish, Santa Fe.

We studied the relationships between cougars and desert bighorn sheep on the San Andres Mountains (SAM), New Mexico. Experimental removal of cougars from a 703 km^2 treatment area (TA) enabled us to examine effects of cougar predation over a range of cougar densities. In the pre-treatment span (1986-1990), adult cougar density increased from 1.17 to 2.01 cougars/yr./100 km^2. In the post-treatment span (1991-1994), adult cougar density increased from 1.09 to 1.87 cougars/yr./100 km^2. Radio-collared desert bighorn sheep comprised 1.9% (n=10) of the animals we found killed by cougars and 0.80% average annual frequency of occurrence in cougar feces. Another 16 radio-collared sheep died of other causes, which included falls from cliffs (n=5), old age (n=3), scabies (n=2), disease (n=2), undetermined causes (n=2), breached birth (n=1), and capture accident (n=1). Scabies (Psoroptes ovis) infested 53% of the radio-collared sheep that died. Survival rates for lambs and yearlings were 0.771 and 0.778, respectively. The average annual survival rates for radio-collared adult sheep and for radio-collared yearling and adult sheep combined were 0.818 and 0.814, respectively. The estimated mortality rates for each age class was applied to data from annual sheep population surveys and yielded results that suggested that the sheep population was relatively stable during the study; we estimated that the population numbered about 40 sheep. Linear regression analyses indicated there were no significant functional relationships between either sheep mortality rates and adult cougar density or cougar predation rates on sheep and adult

cougar density. We concluded that the density of adult cougars was inconsequential to sheep mortality rates and cougar predation rates. Management implications are provided.

Logan, K.A., L.L. Sweanor, and M.G. Hornocker. 1997. Effects of Cougar (*Puma concolor*) Predation on Desert Bighorn Sheep (*Ovis canadensis mexicana*) in the San Andres Mountains, New Mexico. Page 88 in W.D. Padley, ed., Proc. Fifth Mountain Lion Workshop: 27 February- 1 March 1996; San Diego, California.

We quantified the effects of cougar production on a remnant population (range=30-37) of desert bighorn sheep on the San Andres Mountain in southern New Mexico from 1985-1994. At the same time, we intensively studied cougar population dynamics. The finite rate of survival (FRS) for 48 lambs was 0.771. The FRS for 9 radiocollared yearlings was 0.777. Program MICROMORT was used to estimate annual survival rates for 36 radiocollared bighorns (21 ewes, 15 rams) that occupied a 703 km^2 treatment area where we experimentally removed 760.6% of the independent cougars in 1991. Annual survival rates for ewes and rams combined averaged 0.814 (range=0.639-1.0). Of 21 radiocollared sheep deaths, 8 (0.38) were due to cougar predation and 13 (0.62) were due to other causes. Other causes included falls (4), diseases (4), old age (2), unknown (2), and breached birth (1). The mean age of radiocollared sheep killed by cougars was 6.13 years (SD=5.33, range=1-16). Five of 8 sheep killed by cougars had clinical scabies (*Psoroptes ovis*) and 1 was in poor physical condition. The mean age of sheep that died from other causes was 6.46 years (SD=3.57, range=3-14). Nine of 13 sheep that died of other causes had clinical scabies. Two apparently died from scabies. There was no correlation between cougar predation rates on radiocollared sheep and cougar density on the treatment area (r^2=0.022). On the San Andres Mountains, a reduction in cougar density did not cause a corresponding increase in the desert bighorn sheep population.

Logan, K.A., L.L. Sweanor, and M.G. Hornocker. 1997. Survival and Mortality of Cougars (*Puma concolor*) in the San Andres Mountains, New Mexico. Page 88 in W.D. Padley, ed., Proc. Fifth Mountain Lion Workshop: 27 February- 1 March 1996; San Diego, California.

We quantified survival and natural mortality in an unhunted cougar population that we studied for 10 years (1985-1995) on the San Andres Mountains (2060 km^2) in southern New Mexico. Survival rates of cubs were estimated using the finite rate of survival (FRS) for 211 cubs and the change in the mean number of cubs per litter (CN) in 74 litters. Estimated cub survival rates using the FRS and the CN methods were .706 and .725, respectively. The sex ratio of cubs that died was 1:1, identical to the observed sex ratio at birth. Natural causes of mortality were from cannibalism (0.44), starvation (0.37), disease (0.11), accidental fall (0.04), and coyote predation (0.04). Twenty-six radiocollared subadults (16 F, 10 M, 7.6-27 months old) had a FRS of 0.88 for females and 0.60 for males. Survival rates of subadult females and males were not significantly different (X^2=2.62, 1df, P=0.11). All 6 of the subadult cougar deaths were due to intraspecific killing. Annual and span survival rates were estimated for 85 radiocollared adult cougars (51 F, 34 M, 18-152 months old) by using program MICROMORT. Adult female annual survival rates averaged 0.811 (range = 0.523-1.0). Adult male annual survival rates averaged 0.905 (range + 0.790-1.0). The 8-year span survival rate for adult males (0.450) was significantly greater (Z=1.724, P=0.04) than the span survival rate for females (0.188). Intraspecific killing was the greatest mortality factor, causing 50% of the deaths in adult females and adult males. Intraspecific killing of adults was not related to cougar density (Z=0.300, P=0.76). Other natural causes of mortality included accidents (0.22 of female deaths, 0 male deaths), disease (0.11 of female and 0.30 of male deaths), old age (0.06 of female and 0.20 of male deaths) and unknown causes (0.11 of female deaths). Sport-hunting may cause additive mortality in cougar populations.

Logan, K.A., L.L. Sweanor, J.F. Smith and M.G. Hornocker. 1999. Wildl. Soc. Bull. 27(1):201-208.

We evaluated using foot-hold snares to capture desert-dwelling pumas (*Puma concolor*) to inform other researchers of the efficacy of this method. During 1985-1995, we snared 107 individual pumas 209 times. Overall capture success was 1 puma/193 snare days. Initially, males and females were equally susceptible to capture. However, females in particular became snare-shy as they gained experience with snares. Snares were most efficient when set at, in descending order, puma kills, scavenged carcasses, puma scrapes, lures, and on puma travel ways. Snaring was a relatively safe method to capture pumas. Life-threatening injuries occurred in 2.4% of total puma captures. Capture by snares affected the movements of males less than or equal to 2 days post-capture, and had relatively little effect on movements of females. We also caught 89 non-target animals in snares; 16.9% died. Modifications of snares and snare-setting protocols reduced injuries to pumas and capture of non-target animals. Our use of foot-hold snares produced fewer deaths to pumas than

occurred during most other intensive studies that used trained dogs.

Logan, K.A., L.L. Sweanor and M.G. Hornocker. 2003. Reconciling Science and Politics in Puma Management in the West: New Mexico as a Template. Page 146 *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 puma is the only large obligate carnivore thriving today in self-sustaining populations distributed across western North America. As such, the puma contributes to ecosystem integrity because the puma: 1) strongly influences energy flow and nutrient cycling; 2) is a strong natural selective force on prey animals; 3) modulates prey population dynamics; 4) indirectly affects herbivory on plant communities; 5) indirectly influences competition among herbivores; and 6) competes with other carnivores. Furthermore, because persisting puma populations depend on expansive, connected wild landscapes with thriving prey populations, the puma is also a potential focal species for designing nature reserve networks. Wildlife managers have the responsibility of weighing the natural value of the puma with the diverse needs of people. Yet, their tools for scientific puma management are crude mainly because pumas are very cryptic and exist in very low population densities. People in New Mexico identified 10 puma management issues: 1) pumas kill livestock and threaten rancher's livelihoods; 2) pumas kill deer that could be taken by hunters; 3) pumas threaten conservation of endangered populations of mountain sheep; 4) some pumas threaten public safety; 5) sustainable puma hunting is desirable; 6) puma hunting should focus on taking males and protecting females and cubs; 7) hunting pumas with dogs is undesirable; 8) puma hunting is undesirable; 9) increased human development threatens puma conservation; 10) diverse interests make puma management difficult. Unknowns and uncertainties specific to puma management included: 1) number of pumas in populations; 2) population trends; 3) population growth rates; 4) population responses to management prescriptions; 5) effects of hunter selection; 6) density distributions; 7) age and sex structure of populations; 8) reproductive rates; 9) age-specific survival rates; 10) immigration and emigration rates; 11) validity of puma population simulation models. These unknowns and uncertainties along with the broad diversity of human values toward the puma make management very difficult and challenge the professional integrity of agencies. In New Mexico, we developed a robust, biologically sound, adaptive puma management structure that considers the role of the puma in ecosystems, the needs of people, and the unknowns and uncertainties in puma management. We called this structure *Zone Management*. Zone Management uses zones with lethal control, sport-hunting, and refuges. Control zones allow experimental puma control in focal areas to protect private property, human safety, endangered species, or game animals. Hunting zones allow sport-hunting opportunity sustained by quotas on the number of pumas that can be killed, with emphasis on protecting females and cubs. Refuge zones (i.e., no hunting zones) are >3,000 sq. km and act as biological savings accounts that assist wildlife managers by countering mistakes made in the control and hunt zones, allowing natural selection to occur in puma populations, and providing numeric and genetic augmentation of human impacted zones via puma dispersal from refuges and immigration into human exploited zones. The zone management structure uses the source-sink metapopulation paradigm we developed for pumas in New Mexico.

Logan, T. and G. Evink. 1985. Safer Travel for the Panther. Naturalist Spring. Pgs. 6-7.

An integral part of Florida's "Save Our Everglades" program is to protect the Florida panther and its habitat. At the same time, Alligator Alley is scheduled to be upgraded to interstate standards. Cooperation between the Florida Game and Fresh Water Fish Commission and the Department of Transportation hopes to build the interstate to accommodate the movement of wildlife through the habitat. Too many panthers have been killed crossing Alligator Alley and the interstate will improve water flow and will provide undercrossings for panthers and other wildlife. The Game and Fish Commission placed radiocollars on 8 panthers and more than 2000 locations had been documented which will assist planners in mapping habitat preferences and patterns of use.

Logan, T.H., and G. Evink. 1988. A Plan for Florida Panther Safety on Collier County Highways. Prepared for the Technical Subcommittee of the Florida Panther Interagency Committee. 5pp.

Fourteen Florida panthers were known to have been struck by motor vehicles on south Florida highways since December 1979. Eleven of these panthers died and highway deaths are the most often documented source of mortality of Florida panthers. Specific recommendations were made by the Florida Game and Fresh Water Fish Commission which pertained

to the upgrading of State Road 29, a proposed interchange at State Road 29/Interstate 75 and conversion of State Road 84 to Interstate 75. Additional interim actions to provide further protection and reduce the likelihood that panthers will be struck by motor vehicles on State Roads 84 and 29 in Collier County through 1991 are provided.

Long, E.S., D.M. Fecske, R.A. Sweitzer, J.A. Jenks, B.M. Pierce and V.C. Bleich. 2003. Efficacy of Photographic Scent Stations to Detect Mountain Lions. Western North American Naturalist 63(4):529-532.

The authors were interested in developing a protocol for estimating size of mountain lion populations in the Black Hills, South Dakota, using a combination of scent lures and automatic camera systems (sight-resight analysis) due to the cost and precision limitations of currently utilized methodologies. The study was conducted May-August 2000 in the central Black Hills where another radio-collar study had been ongoing since 1999. Photographic scent station locations and scent lure composition are described. Scent stations (n = 14) were monitored for 1121 camera-nights during a 103-day period. Three lions were confirmed within the grid and 3 additional lions were confirmed in the area but no photographs were obtained. Further experimentation with different camera station densities, placement strategies and alternative scents may prove worthwhile.

Lopez, B. 1981. An Elusive Cat. GEO 3:98-116.

The mountain lion was first noted by Western explorers cruising off the coast of Nicaragua in 1502. The Tupi-Guarani Indians of Brazil provided the word "guacu ara" which is the source of our word cougar. The author quotes several biologists concerning previous and ongoing studies on the mountain lion.

Lotz, M.A. and M. Culver. 2005. Feasibility of Extracting Florida Panther DNA from Scats. Page 223 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

The Florida panther *(Puma concolor coryi)* formerly inhabited much of the southeastern United States but today is restricted to the south Florida peninsula and is listed as an endangered species. Early genetic work revealed that Florida panthers had lower numbers of polymorphic alleles and low heterozygosity when compared to western *Puma.* Florida panther genetic restoration was implemented in 1995 as a result of population viability analyses that predicted panther extinction based on continual erosion of genetic variability common to small, isolated populations. Field collection of panther scats is a non- invasive technique that could potentially offer the safest and most cost effective tool for censussing numbers of panthers, measuring population genetic health, and identifying the origins of *Puma* sign found outside of core panther areas. We evaluated the use of panther scats as a source of DNA samples for on-going genetic monitoring. Nine scats were collected in 4 months from 404.8 km of transects, established on existing trails of four different management areas, for an average of 1 scat per 45 km traveled. Conversely, 17 scats were collected opportunistically while perfoming other field activities, primarily during scheduled panther capture and recollar efforts, during a 6-month period. Sixty percent (21 of 34) of the scats collected yielded viable panther DNA (felid microsatellite PCR product). Existing tissue samples were used to calibrate and verify the utility of extracting and analyzing DNA from scats. Preliminary genetic analyses on these tissue samples have shown the ability to identify Florida panthers, segregate individual panthers into various groupings based on amount of genetic material derived from Texas puma and provide discrete measurements of individual allelic diversity and heterozygosity. DNA extraction from scats may complement or eventually replace handling live panthers if the only need is to assess population genetic characteristics. Because Florida panther scats were infrequently encountered along transects, we suggest opportunistic collection while conducting other field activities may prove more efficient than standard survey routes.

Lowery, G.H. Jr. 1936. A Preliminary Report on the Distribution of Mammals in Louisiana. Proc. La. Acad. Sci. 3:11-39.

Now virtually extinct in the State, the Florida cougar occurs only in limited numbers along the Tensas and possibly the Atchafalaya River. One or two are killed about every year in Madison and Richland parishes. A female was killed at Waverly in 1931. A specimen was reportedly taken 12 miles south of Vidalia.

Lowery, G.H. Jr. 1943. Mammals of Louisiana and Adjacent Waters. LSU Occas. Papers Mus. Zool. 13:213-257.

The cougar was apparently restricted almost entirely to the swamps of northeastern and eastern Louisiana and the lower Atchafalaya River bottoms. It was reported that reliable persons spotted two cougars feeding on a freshly killed pig on the highway between Robeline and Spanish Lake, in Natchitoches Parish during the fall of 1939. If authentic, this record constitutes by far the most recent occurrence of the species in western Louisiana where it had been nearly if not wholly extirpated.

Lowery, G.H. Jr. 1974. The Mammals of Louisiana and Adjacent Waters. LSU Press, Baton Rouge. 565pp.

The cougar once occurred in most of Louisiana's hardwood forests, but has been extirpated in most areas and only a few remain. Measurements and weights of some specimens are listed. Some records of the cougar in Louisiana are provided. The author had an occasion to eat cougar flesh and found it to be very tasty.

Loxterman, J.L., J.W. Laundre and M.B. Ptacek. 2003. The Relationship Between Dispersal and Gene Flow Among Populations of Mountain Lions (Puma concolor) in Fragmented Habitat. Pages 70-71 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

The relationship between dispersion patterns of organisms and the actual movement of genes is difficult to address. While direct measurements of the movement of individuals between populations can shed light on their degree of geographic connectedness, knowing whether or not dispersers contribute to gene pools outside their natal subpopulation is essential to understanding the genetic structure of a species. Two methods are commonly used to estimate migration. Indirect estimates of gene flow are based on genetic markers and direct estimates of dispersal are based on mark-recapture data, however, each have their respective applications and limitations. Many of these limitations can be overcome by combining data gathered using each method with knowledge about dispersal patterns and population structure. Our study provides an opportunity to combine indirect estimates of gene flow using nuclear microsatellite data with direct estimates of dispersal using radio-telemetry data. Preliminary results for 12 loci from 4 subpopulations in south central Idaho and surrounding states suggests concordance between the degree of genetic differentiation and gene flow estimates between pairs of subpopulations (FST = 0.0 - 0.02, Nm =10 - infinite: RST = 0.0 - 0.13, MR = 1.7 - infinite) and estimates of dispersal (30 dispersers: 23 males and 7 females) based on radio-telemetry data. Results of this study will provide information on the relationship between indirect and direct estimates of gene flow in a large, vagile species and may be important in assessing the impact of habitat fragmentation on the population genetic structure of mountain lions in Idaho.

Loxterman, J. 2011. Fine Scale Population Genetic Structure of Pumas in the Intermountain West. Conservation Genetics 12(4):1049-1059.

Abstract

In this study, I examined the population genetic structure of subpopulations of pumas (Puma concolor) in Idaho and surrounding states. Patterns of genetic diversity, population structure, levels of inbreeding, and the relationship between genetic differentiation and dispersal distance within and between 15 subpopulations of pumas were compared. Spatial analyses revealed that the Snake River plain was an important barrier to movement between northern and southern regions of Idaho. In addition, subpopulations south of the Snake River plain exhibited lower levels of genetic diversity, higher levels of inbreeding, and a stronger pattern of isolation by distance relative to subpopulations north of the Snake River plain. Lower levels of diversity and restricted gene flow are likely the result of historically lower population sizes in conjunction with more recent changes in habitat use and available dispersal corridors for movement. The subdivision of puma populations north and south of the Snake River plain, along with the patterns of genetic diversity within regions, indicate that landscape features are affecting the population genetic structure of pumas in Idaho. These results indicate that information about the effects of landscape features on the distribution of genetic diversity should be considered when designing plans for the management and conservation of pumas.

Lucherini, M, J.I. Reppucci, R.S. Walker, M.L. Villalba, A. Wurstten, G. Gallardo, A. Iriarte, R. Villalobos and P. Perovic.

2009. Activity Pattern Segregation of Carnivores in the High Andes. J. Mammal. 90(6):1404-1409.

Abstract

Intraguild competition may be reduced if ecologically similar species segregate temporally. Using data from 1,596 camera-trap photos, we present the 1st quantitative analyses of the activity patterns of Andean cats (Leopardus jacobita), Pampas cats (Leopardus colocolo), culpeos (Lycalopex culpaeus), and pumas (Puma concolor) in high-altitude deserts of the Andes. We compared daily activity patterns for these carnivores with those of mountain vizcachas (Lagidium viscacia), the main prey of Andean cats. Activity patterns of all species were positively skewed toward night. Pampas cats displayed the greatest proportion of nocturnal activity, whereas Andean cats were the most diurnal. Activity of Andean cats differed significantly only from that of Pampas cats; Pampas cats also differed from pumas. Activity of Andean cats was generally similar to that of mountain vizcachas. The dissimilar activity patterns of Andean and Pampas cats support the hypothesis of temporal niche segregation of these felids.

Ludwig, G., L. Aguiar, J. Miranda, T. Gustavo, S. Walfrido, M. Luciano, S. Marcos, H. Carmen, N. Italmar and P. Fernando. 2007. Cougar Predation on Black-and-Gold Howlers on Mutum Island, Southern Brazil. International Journal of Primatology 28(1):39-46.

Abstract

Researchers consider predation rates by terrestrial animals to be lower in the case of arboreal primates, particularly among large-bodied species. We recorded the consumption of black-and-gold howlers (Alouatta caraya) by cougars (*Puma concolor*) as evidence of predation on an island of the upper Paraná River. We collected and processed fecal samples of the felid in 2004 and 2005. We identified items in the laboratory by comparison with museum specimens. We considered each species in a fecal sample as a single occurrence. Based on analysis of the cuticle scale pattern, we identified the felid as cougar. Howlers occurred in 4 out of the 8 fecal samples (40% of the occurrences). In addition to howlers, we also recorded 5 occurrences of agouti (*Dasyprocta azarae*; 50%) and a small unidentified sigmodontine rodent (10%). The abundance of howlers and the low forest canopy in a successional vegetation might have facilitated the predation of the large primates by a primarily terrestrial predator. The versatility of cougars is corroborated by the consumption of prey species that were abundant in the region and that were available in different forest strata, such as howlers and agoutis.

Lukas, J. 1992. The Role of Captive Breeding in the Recovery of the Florida Panther. AAZPA Regional Proceedings. Pgs. 566-572.

The Florida panther (Felis concolor coryi) was driven close to extinction by European settlement practices only 50 years after it was recognized as a unique subspecies. It was given protected status in 1958 and was listed as an endangered species in 1967. Estimates indicate that occupied panther range in south Florida totals 2.2 million acres, 55% of which is in state or federal ownership. Facilities were built to hold panthers at White Oak Conservation Center to work with injured panthers initially and later to become a part of the captive breeding effort. Three male and three female kittens between the ages of 6-9 months arrived at White Oak in 1991 and every effort was made to keep exposure to people at a minimum in case they needed to be released into the wild. Six permits were issued for 1992 and one male kitten was captured and brought to White Oak in 1992. The other kittens to be removed from the wild in 1992 will be neonates and are scheduled to go to the Jacksonville Zoo and Lowry Park Zoo and will remain in captivity as breeders. White Oak has also been working with Texas cougars in a surrogate program. Reintroduction is the most critical part of this approach to recover the Florida panther. Experimental re-introductions involving western cougars to study a wild to wild release were initiated in 1988. Despite problems, it was encouraging that the cougars appeared to adapt and develop typical patterns and find suitable prey and cover. Permitting wild caught females to raise their young on natural prey in large areas is perhaps the best chance for success. Artificial insemination is another hope for the future of the species.

Lydekker, R. (ed.). 1894. The Puma (Felis concolor). The Royal Natural History 1:397-406. Frederick Warne and Co., London and New York.

The puma's physical characteristics and range are described. The largest authenticated specimen on record was one

killed in Texas in 1846, with a total length of 8 feet 2 inches, the length of the tail being 3 feet 1 inch. The puma is very partial to horse-flesh and particularly of colts and also will take calves, rarely cows, and sheep. It is stated that the puma attacks the jaguar in South America and exhibits marked hostility to the grizzly bear in North America and is one of the boldest and fiercest of carnivores in proportion to its size. Accounts of the South American puma are presented where it resigns itself to death when captured and does not resist at all, except whenever dogs are used and the opposite is true. There are stories that the South American puma will actually guard human beings when threatened with attack by other animals. Pumas usually refrain from attacking man, but there are several instances on record where they have attacked, even in open daylight. One case was in the spring 1886, when some children from Olympia, Washington were returning home from school. A six year old boy was grabbed by a puma while walking in front of his older brothers and was taken out of sight into some bushes. The oldest brother was able to rescue his brother by beating the cat on the head with an empty bottle until it shattered and then attempted to gouge the cats eyes out with the broken bottle. Another instance occurred to a Swedish sailor in British Columbia who was repeatedly attacked until he was able to kill it with a shovel. Pumas have been known to leap upwards to a height of twenty feet and horizontal leaps of close to 40 feet on snow are on record.

Lynch, W. 1989. The Elusive Cougar. Canadian Geographic. August. Pgs. 24-31.

The persecution of the cougar continued in Canada until the 1960's, when its status as vermin was abolished and all bounties were removed. British Columbia and Alberta are home to most of Canada's remaining cougars. One writer found 42 different English names for the cougar and it is listed in dictionaries under more names than any other animal in the world. The author describes the Alberta Cougar Project, a privately funded study located around Sheep River in the foothills of Alberta, 80 kilometers southwest of Calgary. The researchers, Martin Jalkotzy, Ian Ross, and Ralph Schmidt had radio-collared 70 cougars in the previous seven years and were presently monitoring the movements of 15. Solitary adult females had an average home range of 158 km^2 and will vary according to reproductive status. Adult males have a home range which averages 364 km^2, which is considerably larger than females and likely helps to increase breeding opportunities. The population density was 3.5 cougars per 100 km^2, one of the highest of any area studied. Home ranges of resident females sometimes overlapped completely and resident male home ranges never overlapped more than 20 percent. Cougars breed at any time of the year in Alberta. Females are normally in heat for about 8 days and copulation may be as often as 50 to 70 times in a 24-hour period. Alberta researchers estimate that 600-700 cougars inhabit the province.

Mabie, D.W. 1983. Feline Status Study. Ann. Perf. Report. Fed. Aid Proj. No. W-103-R-13, Job 12, Texas Parks and Wildl. Dept., Austin. 5pp.

Four of the six native Texas cats are classified as endangered. Two, the margay (Felis weidii) and jaguar (Panthera onca), probably do not occur in Texas. The ocelot (Felis pardalis) and jaguarundi (Felis yagouaroundi cacomitli), though rare in their historic ranges, occur locally where protected habitat is available. Mountain lion (Felis concolor) records for 1975-83 were obtained from Department personnel to prepare a generalized range map of recent occurrence relative to endangered feline species in the state. Cooperative information exchange was continued with research personnel at Texas A&I University who are studying the ocelot in South Texas. No verified occurrence of jaguarundi was made during this segment, but several possible sightings were recorded at an undeveloped park site near the Rio Grande.

Mabie, D.W. 1984. Feline Status Study. Ann. Perf. Report. Fed. Aid Proj. No. W-103-R-14, Job 12, Texas Parks and Wildl. Dept., Austin. 3pp.

Cooperative information exchange was continued with researchers involved with studies of wild felines in Texas. Five pertinent sighting reports were received and transmitted to appropriate investigators. A pattern of routine jaguarundi sightings in Brazoria County continued in this segment. Sight and kill reports of the mountain lion indicate that the population has increased. Department biologists and wardens reported that at least 178 lions were killed in Texas in 1977, with 27 of those taken on one ranch.

Macgregor, W. 1971. The Status and Management of the Mountain Lion in California. Pgs. 99-100 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.

Prior to 1969, mountain lions were classified as nonprotected animals and as predatory animals earlier. Bounties were paid on mountain lions from 1907 to 1963 out of the Fish and Game Preservation Fund and totaled 12,461 lions costing $389,345. The bounty was discontinued in 1963 and abolished in 1967. In 1969, the status of the lion was changed to that of a game mammal, and tags were required for the taking of lions except when they were damaging or threatening to damage livestock or private property. This legislation gave the Fish and Game Commission authority to regulate and protect the lion in California and enabled the Commission to prohibit the taking of lions with traps and poisons as well as to prohibit the capture or possession of live lions except under a permit. The Department is recommending a one-lion limit- and approximately 7 months of closure during the main period in which the lions have dependent young animals. A bill had been introduced which would remove the lion from the list of game mammals and would prohibit all hunting of lions. It also would change the provisions on depredating lions with the Department investigating all reports and if found to be caused by a lion, the Department would capture the animal alive if possible. Another bill introduced would prohibit the use of dogs in hunting mountain lions. The lion bounty was in effect from 1907-1963 and the take varied from a high of 482 in 1908 to a low of 105 in 1963, when the bounty was lifted before the end of the full calendar year. The State Department of Fish and Game employed lion hunters until 1959 to control lion populations. Two of the most successful state lion hunters were Jay Bruce and C.W. Ledshaw, taking a total of 923 lions. Subtracting the take of lions by state hunters, the number of lions taken during the previous 25 years was relatively stable, amounting to between 100 and 160 animals. From July, 1970, through January, 1971, 2,579 lion tags were sold. From July 1, 1970 to February 28, 1971, a total of 51 lions (4 immature males, 26 adult males, 2 immature females, and 19 adult females) had been reported on tags.

MacGregor, W.G. 1974. The Status of the Puma in California. The World's Cats 3(1):29-34.

Two subspecies of puma are found in California; the California puma (Felis concolor californica) and the Yuma puma (Felis concolor browni). The puma was classified as a predator in California with a bounty on its head from 1907 through 1963. During that period, 12,461 pumas were bountied. From 1963 through 1969, the puma was classified as a non-protected animal and the bounty was removed. In 1969, the puma was reclassified as a game mammal and a license was required to kill it. The Fish and Game Commission was given authority to regulate the harvest at this time. During the 1970 season, 83 pumas were taken. In 1971, the Legislature passed a bill which established a 4-year moratorium on the sport hunting of pumas. A depredation permit could be issued for a 10 day period if it was determined by Fish and Game personnel that the puma had caused the damage and was only good within 10 miles of where the depredation occurred. It was determined that there was approximately 74,000 square miles of puma habitat within California and an estimated population of 2,400 pumas. The population could vary anywhere from 1,400 to 3,800 animals. It appeared that male pumas occupied a range of approximately ten miles long by 5 miles wide, following the courses of major drainages, with females occupying a slightly smaller area of approximately 7 miles long by 3 miles wide. The author concluded that the status of the puma in California is secure, with populations at the carrying capacity of the habitat presently available.

Maehr, D.S. 1987. Florida Panther Movements, Social Organization, and Habitat Utilization. Perf. Rep., Study No. E-I-11 II-E-2. Florida Game and Fresh Water Fish Commission. 21pp.

A total of 1,464 radio locations were used to determine home range sizes of 10 Florida panthers in Collier and Hendry counties. Adult males averaged 507 km^2 and adult females averaged 184 km^2. A juvenile male and female used areas of 433 km^2 and 70 km^2, respectively. Frequent interactions among adult males and a female with kittens were documented as was an aggressive encounter between an adult male and juvenile male. Two panthers were treated at the Miami Zoo, one had been wounded from a gunshot and the other had been injured by a motor vehicle. Diel monitoring revealed activity peaks around sunset and sunrise with inactivity occurring during mid-day. Day use sites typically are dense saw palmetto thickets that may provide thermal advantages as well as security. An adult female panther was removed from the Fakahatchee Strand State Preserve for nutritional evaluations and captive breeding. Panther #09 has exhibited behavior typical of parturition and denning. Intensive monitoring will continue in order to document number of kittens and associated maternal behavior. A preliminary panther population model was developed. Refinements are still necessary but it demonstrates the impacts of recruitment rates, litter size, and kitten survival.

Maehr, D.S. 1988. Florida Panther Movements, Social Organization and Habitat Utilization. Perf. Rep., Study No. E-I-12

II-E-2. Florida Game and Fresh Water Fish Commission. 19pp.

A total of 3,079 radio locations were used to determine home range sizes of 13 Florida panthers (Felis concolor coryi) in Collier, Hendry, Highland, Glades, and Hardee counties. Adult male ranges averaged 661 km^2 and adult females' averaged 350 km^2. A subadult female used a 97 km^2 area. Home range shifts by 2 panthers in the Fakahatchee Strand may have resulted from the loss of 2 adult females and low water levels. Habitat characteristics varied from north to south with higher quality lands more abundant in the northern part of the study area. Female productivity was directly related to prey abundance while female home range size was inversely related to prey abundance.

Maehr, D.S. 1988. Early Maternal Behavior in the Florida Panther. Appendix B In: Florida Panther Movements, Social Organization and Habitat Utilization. Perf. Rep., Study No. E-1-12 II-E-2. Florida Game and Fresh Water Fish Commission. 19pp.

Intensive monitoring of 2 radio-collared, adult female Florida panthers (Felis concolor coryi) from January 1985 through December 1987 revealed behavior patterns associated with kitten rearing. Reductions in home range size immediately after parturition were followed by an increase in area used by #09 and decreased area use by #11. Activity was highest between 1600 and 2400 and absences from the den increased as kittens aged. Prey abundance may explain some of the observed behavioral differences between the 2 females.

Maehr, D.S. 1988. Florida Panther Road Mortality Prevention. Final Perf. Rep., Study No. E-I-13 II-E-8. Florida Game and Fresh Water Fish Commission. 8pp.

Sixteen Florida panthers (Felis concolor coryi) are known to have been struck by motor vehicles on south Florida highways since December 1979; at least 12 of these instances were fatal. In 3 cases, an injured panther was recovered at the accident site and survived as a result of veterinary care in captivity. Only 2 of these animals recovered to the extent that they could be returned to former territories in the wild. While the relative significance of highway deaths to other sources of mortality of the Florida panther is not known, it is the most often documented source of mortality.

Maehr, D.S., J.W. McCown, E.D. Land, and J.C. Roof. 1988. Panther Research Update for Southwest Florida. 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.

A total of 3,079 radio locations were used to determine home range sizes of 13 Florida panthers (Felis concolor coryi) in Collier, Hendry, Highlands, Glades, and Hardee counties. Adult male ranges averaged 661 km^2 and adult females' averaged 350 km^2. A subadult female used a 97 km^2 area. Home range shifts by 2 panthers in the Fakahatchee Strand may have resulted from the loss of 2 adult females and low water levels. Habitat characteristics varied from north to south with higher quality lands more abundant in the northern part of the study area. Female productivity was directly related to prey abundance while female home range size was inversely related to prey abundance. White-tailed deer (Odocoileus virginianus) track counts, hunter returned biological samples and a fall collection of doe deer were utilized to compare deer herds inhabiting Florida panther habitat in the Bear Island (BI) and Monument Units (EMU) of the Big Cypress National Preserve (BCNP), the Fakahatchee Strand State Preserve (FS), Fakahatchee Conservation Club (FCC), and Collier Enterprise (CE) lands. This was part of an effort to provide information on deer health parameters, numbers and distribution, sex and age structures and reproductive rates and trends. Differences in herd densities and physical condition parameters were noted with CE lands containing a denser and generally healthier deer herd than other areas. Thirty-two white-tailed deer have been captured in the BI, 27 of which have been radio-instrumented. Cause of mortality was determined for 5 marked deer that were known to have died during the study period. There was no difference in survival rates among 3 intervals: summer 1987 (1 June-6 Nov.), hunting season (7 Nov.-3 Jan. 1988), and spring 1988 (4 Jan.-31 May). Overall, the survival rate was 0.71 (95% CI=0.53, 0.96). Average doe home range size was 173 ha and a radioed buck used 812 ha. Three does made extensive movements (2-10 km) outside their normal use area for unknown reasons. Six radioed does successfully raised fawns past the first critical weeks postpartum and six other does do not appear to be accompanied by fawns this season. Comparisons to herd reproductive status data suggest a neonate mortality rate of 43.5-63.2%, but these calculations are preliminary and based on small sample sizes.

Maehr, D.S., E.D. Land, J.C. Roof, and J.W. McCown. 1989. Early Maternal Behavior in the Florida Panther (Felis

concolor coryi). Am. Midl. Nat. 122:34-43.

Intensive monitoring of two radio-collared, adult female Florida panthers (Felis concolor coryi) from January 1985-December 1987 revealed behavior patterns associated with rearing of kittens. Reductions in home-range size immediately after parturition were followed by an increase in area used by one female and decreased area used by another. Activity was highest between 1600 and 2400 h and absences from the den increased as kittens aged. Prey abundance may explain some of the observed behavioral differences between the two females.

Maehr, D.S., J.C. Roof, E.D. Land, and J.W. McCown. 1989. First Reproduction of a Panther (Felis concolor coryi) in Southwestern Florida, USA. Mammalia 53(1):129-131.

A rare instance of first reproduction in a known-age female panther in southwestern Florida is reported. Radio-collared females suspected of being pregnant were monitored at least three days per week after exhibiting denning behavior. Presence of kittens was determined by the location of tracks 60 days postpartum when the den site was abandoned. A nine-month old female kitten was captured and radio-collared on February 9, 1987. She was born on May 15, 1986 in the Bear Island Unit of the Big Cypress National Preserve, Collier County, Florida. From capture through October, 1988, she used a 97 km^2 home range completely contained within the boundaries of her mother's 239 km^2 home range, although she was infrequently in the same location as her mother. On August 3, 1988, when 26 months old, she was observed with 4 spotted 9-14 kg kittens which possessed characteristics of being approximately 20 weeks old. This corresponded with a mid-March birth date and indicated that she conceived before 20 months and gave birth before 2 years of age.

Maehr, D.S., J.C. Roof, E.D. Land, J.W. McCown, R.C. Belden, and W.B. Frankenberger. 1989. Fates of Wild Hogs Released into Occupied Florida Panther Home Ranges. Florida Field Naturalist 17(2):42-43.

The feasibility of wild hog introductions as a means of artificially augmenting the panther prey base south of Alligator Alley was examined. Six castrated hogs were released 27 March 1987 in the Fakahatchee Strand State Preserve within 1 km of a radio-collared adult female panther. Another six hogs were released 28 March in the privately-owned Golden Gate area south of Alligator Alley within 200 m of a radio-collared female panther and her 8-month-old male kitten. Predators were implicated in the deaths of five hogs, and included 2 black bears, 1 alligator, 1 panther, and 1 unknown predator. The single panther kill occurred 117 days after release within 4 km of the release site.

Maehr, D.S., and D. Decker. 1989. What Happened to Cat #12? Telonics Quarterly 2(3):2.

Telonics had been providing the radio telemetry equipment for the Florida panther study since 1981. A radio collar had apparently failed on adult male panther #12 after functioning normally for almost 10 months. When panther #12 was recaptured, a large dent with a small puncture hole was discovered in the external casting which indicated it was caused by the upper canines of an adult male panther. The collar may have prevented more serious injury by protecting the throat.

Maehr, D.S. 1990. Florida Panther Food Habits and Energetics (July 1, 1987 - June 30, 1990). Final Performance Report. Study No. 7503, Federal No. E-1 II-E-3. Florida Game and Fresh Water Fish Commission.

We examined the diet of Florida panthers (Felis concolor coryi) in southwest Florida from 1977 through 1989. Frequency of occurrence in 270 scats indicated wild hog (Sus scrofa) was the most common prey followed by white-tailed deer (Odocoileus virginianus), raccoon (Procyon lotor), and 9-banded armadillo (Dasypus novemcinctus). No seasonal variation in diet was found; however, panthers inhabiting an area of better soils consumed more large prey.

Maehr, D.S. 1990. Florida Panther Movements, Social Organization, and Habitat Utilization (July 1, 1987 - June 30, 1990). Final Performance Report. Study No. 7502, Federal No. E-1 II-E-2. Florida Game and Fresh Water Fish Commission. 115pp.

Analyses of Florida panther (Felis concolor coryi) habitat use, movements, and social interactions in southwest Florida were based on 6,845 radio locations of 24 panthers collected between January 1985 and June 1990. Panthers prefer uplands, especially hardwood hammocks and pine flatwoods over wetland forest cover. Forested uplands cover a

relatively small area of inhabited panther range but receive a disproportionately high level of use. Daytime cover and female den sites usually are located in dense understory vegetation, typically saw palmetto (Serenoa repens). Daybeds usually are relocated daily, while den sites are used for up to 2 months by female panthers and their litters from parturition to weaning. Home range size varied from 53 to 1,183 km^2 and averaged 191 km^2 for adult females and 558 km^2 for adult males. Home range shifts were documented in adult females as the result of a home range vacancy and dispersal from a natal range. Shifts in adult male home ranges were due to male deaths and home range establishment by an adjacent male. Four resident, dominant adult males were monitored, the other 8 were subadults or non-residents. All adult females were considered residents. Dispersal was documented in 7 panthers. Mean dispersal distance for 6 males (mean age-17.3 months) was 51.8 km (range 22-80 km), and was 16 km for 1 female. Two dispersing subadult males were killed by resident adult males. Florida panthers are essentially solitary except while females raise kittens and during mating or attempted mating. The most frequent interactions were between females and their kittens, followed by adult males and adult females, and adult males and subadult females. Adult panthers are usually >2km apart. Florida panthers exhibit mortality patterns typical of unhunted mountain lion populations. Turnover in adult residents is extremely low and mortality in subadult males is relatively high. The lack of frequent home range vacancies makes the likelihood of male recruitment low. The greatest known cause of panther mortality is highway collision (n=13), however, this number is skewed towards males and panthers living in or adjacent to the Fakahatchee Strand. Indirect human disturbance factors affecting Florida panthers may include activity associated with hunting and highways. Panthers use Bear Island significantly less during the hunting season than non-hunting season. Adult female panthers avoid busy paved highways while males readily cross them. Female panthers appear to distribute themselves evenly through available habitat but do not include I-75 as parts of their home ranges. Thirteen natal dens of 6 female panthers were documented (including one in July 1990). Litter size after 2 months ranged from 1 to 4. Parturition dates ranged from January (n=1) to July (n=3). No births occurred in February and 4 occurred in March. Two older female panthers did not successfully reproduce during the reporting period. According to interactions with females, at least 6 adult males sired litters. Age at first reproduction in female panthers is 18.5 months. The age of first known sexual activity in male panthers is about 3 years. Activity of Florida panthers peaks around sunrise and sunset. The lowest activity occurs during the middle of the day. Female panthers at natal dens follow a similar pattern with less difference between high and low activity periods. Although some travel occurs during the day, panthers are mostly nocturnal. From a demographic and behavioral perspective, panthers in southwest Florida exhibit characteristics typical of healthy mountain lion populations. Reduced habitat availability has resulted in limited recruitment opportunities for subadult males. Continued loss and fragmentation of native landscapes in southwest Florida will reduce the ability of panthers to function normally and will exacerbate problems associated with low numbers.

Maehr, D.S. 1990. The Florida Panther and Private Lands. Conservation Biology 4(2):167-170.

Intensive efforts to protect Florida panther (Felis concolor coryi) habitat on private lands are essential for this endangered animal to survive. About half of the presently known occupied panther range in south Florida occurs on private lands where agricultural and urban development are increasing rapidly. Panther conservation strategies must go beyond traditional land acquisition by government and include economic programs to preserve critical landscapes on private lands.

Maehr, D.S., R.C. Belden, E.D. Land, and L. Wilkins. 1990. Food Habits of Panthers in Southwest Florida. J. Wi1dl. Manage. 54(3):420-423.

We examined the diet of Florida panthers (Felis concolor coryi) in southwest Florida from 1977 through 1989. Frequency of occurrence in 270 scats indicated wild hog (Sus scrofa) was the most common prey followed by white-tailed deer (Odocoileus virginianus), raccoon (Procyon lotor), and 9-banded armadillo (Dasypus novemcinctus). No seasonal variation in diet was found; however, panthers inhabiting an area of better soils consumed more large prey.

Maehr, D.S., E.D. Land, J.C. Roof, and J.W. McCown. 1990. Day Beds, Natal Dens, and Activity of Florida Panthers. Proc. Annu. Conf. Southeast Fish and Wildl. Agencies 44:310-318.

Day rest sites and natal dens of Florida panthers (Felis concolor coryi) studied from January 1986 to August 1989 were dominated by dense vegetation, especially saw palmetto (Serenoa repens). Activity peaked around sunrise and sunset for both denning females and solitary panthers, however, solitary panthers exhibited greater extremes in activity and inactivity. Females were most likely to be at the den during daylight and spent about 50% of the denning period at the den.

Day beds and den sites are important habitat features and should be considerations in panther management.

Maehr, D.S., E.D. Land, and J.C. Roof. 1991. Social Ecology of Florida Panthers. National Geographic Research and Exploration 7(4):414-431

SUMMARY

We monitored 26 radio-collared panthers (Felis concolor coryi) in southwest Florida from December 1985 through October 1990 and collected data on 7025 locations. Panthers preferred native upland forests over wetlands and disturbed habitats. Home-range size varied from 53 to 1183 km^2, averaging 519 km^2 for resident males and 193 km^2 for resident females. Home ranges of resident adults were stable unless influenced by death of other residents. Dispersal distances averaged 58.7 km for subadult males and 16 km for an adult female. One male and one female were successfully recruited into the population during the five years. Florida panthers exhibit demographics and social ecology typical of solitary felids. Limited dispersal opportunities for subadult males may have encouraged fighting among males. Conservation strategies should emphasize upland forest preservation and increasing panther range to accommodate their dispersal.

Maehr, D.S., and C. Belden. 1991. The Endangered Florida Panther. Florida Wildlife 45(3):15-18.

The life history and habits of the Florida panther are described. The reasons for its decline and what is being done to help the panther as well as how you can help are provided.

Maehr, D.S. 1992. Florida Panther Distribution and Conservation Strategy. Florida Panther Research. Study No. 7572, Federal No. E-I II-E-4. Final Report. 30pp.

Panther occurrence in south Florida may be a product of landscape island size as defined by highways, large property ownerships with restricted access, and a predominance of undeveloped wetlands. Hardwood hammocks and mixed swamps correlated positively with increasing panther use. Freshwater marsh, cypress swamp, hardwood swamp, and agricultural lands accounted for 62% of the area in panther home ranges. Habitats avoided by panthers included agricultural, barren land, shrub and brush, and dry prairie. The areas most heavily used by panthers occur on private lands, and are in need of protection. Twelve private ranches covering 2,357 km^2 account for most of this land.

Maehr, D.S., J.C. Roof, E.D. Land, J.W. McCown, and R.T. McBride. 1992. Home Range Characteristics in a Florida Panther in South-central Florida. Fla. Field Nat. 20(4):97-103.

An adult male Florida panther was radio-monitored from 30 January to 22 August 1988 in Glades and Highlands counties. He used 1182 km^2, preferred forested uplands, and avoided unforested habitats. His large home range may have been due to young age, lack of other resident panthers, a high degree of avoided habitats, and habitat fragmentation.

Maehr, D.S. and C.T. Moore. 1992. Models of Mass Growth for 3 North American Cougar Populations. J. Wildl. Manage. 56(4):700-707.

Previous studies of cougar (Felis concolor) physiology and population dynamics relied on growth curves of cougars obtained from diverse locations and under various rearing conditions. We were concerned about potential biases in studies that make but do not test the implicit assumption of homogeneity of growth characteristics among collection sites. Thus, we compared body masses of wild cougars from populations in Florida (F.c. coryi), Nevada (F.c. kaibabensis), and California (F.c. californica). We modeled mass as a nonlinear Richards function of age for each sex and population demographic group. Groups were consistent with respect to estimated birth mass and location of the inflection point of the growth curve. Adult mass was greater ($P<0.001$) in males than females in all populations, and the size of the difference was similar among populations. Estimated adult masses of Florida and California cougars were not different ($P= 0.381$) from each other but were less ($P<0.001$) than that of adult Nevada cougars. Growth rate varied by population but not by sex; Nevada cougars grew fastest to adult mass. Cougar mass is too variable to serve alone as an indicator of age

beyond 24 months. Failure to control for population-specific influences on growth may bias inferences about growth.

Maehr, D.S. 1993. Response to the Wild Florida Panther Population to Removals for Captive Breeding. Study No. 7571, Fed. No. E-1 II-E-2. Final Rep., 8pp.

Telemetry data were gathered from 28 radio-collared Florida panthers (Felis concolor coryi) in southwest Florida during the reporting period. Mortalities of instrumented panthers over the 3-year period included 7 males and 2 females. In addition, 2 uncollared, dependent kittens were killed on S.R. 29 north of I-75. A malfunctioning transmitter reduced the number of monitored panthers to 18 in 1993. Twenty-two panther kittens were handled over a 28 month period including 7 (5M, 2F) that were instrumented and released, 10 (5M, 5F) that were taken into captivity, and 5 neonates (3M, 2F) that were tattooed and returned to their dens. One male neonate was subsequently captured and instrumented in 1993 as panther #54. We have not observed the loss of resident panthers without their replacement since 1991, when removals began. All known resident adult home ranges remained occupied. Dispersal and recruitment patterns were unchanged relative to the previous 3 years of study. Two female siblings, #48 and #52, dispersed from their mother's home range and established residencies within 15 km of their natal range in 1993. Due to efforts to address genetic restoration in the Florida panther, removals of kittens for expanding the captive breeding program were suspended during spring 1993.

Maehr, D.S. and J.A. Cox. 1995. Landscape Features and Panthers in Florida. Cons. Biol. 9(5):1008-1019.

We used a geographic information system (GIS) to document spatial associations of Florida panthers, land cover, and other geographical features. Panther radio locations (n =14,548) occurred in hardwood hammock, mixed hardwood swamp, and cypress swamp in greater proportion than in randomly positioned points (n = 8500). Panther radio locations occurred less frequently in agricultural, barren, and shrub and brush land cover. Panther home ranges consisted of a combination of preferred and avoided cover types, including freshwater marsh, cypress swamp, hardwood swamp, and agricultural land. These cover types accounted for 62% of the area in panther home ranges. We used correlation and discriminant function analyses to assess the potential importance of 20 landscape features. These panther locations were effectively distinguished from random points using four landscape variables: (1) the size of a contiguous patch of preferred land cover; (2) The proximity to preferred land cover; (3) the diversity of three preferred cover types within a window 120 X 120 m, and (4) the matrix within which preferred cover types occurred. Eighty-three percent of the panther locations and 81.9% of the random points were correctly classified based on a linear model constructed using these four variables. Large contiguous areas of preferred land-cover types were especially important because 96% of all panther locations occurred within 90 m of preferred land cover. The average preferred forest patch size that was used by these panthers was 20,816 ha, and a regression equation suggests that patches larger than 500 ha are important. Maps of panther habitat suitability were developed using coefficients derived from discriminant analysis. Large areas of suitable land cover that are heavily used by panthers occur on private ranches covering 3606 square km. Conservation of preferred habitat on these private lands is essential to maintaining a free-ranging population of panthers in southwest Florida.

Maehr, D.S., E.C. Greiner, J.E. Lanier, and D. Murphy. 1995. Notoedric Mange in the Florida Panther (Felis concolor coryi). J. Wildl. Dis. 31(2):251-254.

Notoedric mange (Notoedres cati) was found in a neonate Florida panther (Felis concolor coryi) and presumably its mother on 22 June 1992 and 8 February 1993, respectively, in Collier County, Florida (USA). Both infestations were treated successfully with 0.2 mg/kg ivermectin. This is the first known case of notoedric mange in the endangered Florida panther.

Maehr, D.S. and J.P.Deason. 2002. Wide-Ranging Carnivores and Development Permits: Constructing a Multi-Scale Model to Evaluate Impacts on the Florida Panther. Clean Technologies and Environmental Policy 3(4):398-406.

Abstract

A new endangered species habitat evaluation method based on spatial variables and behavior was developed and applied in a recent development permit application process in south Florida. It utilizes aspects of habitat quality, landscape arrangement, movement tendencies, and human disturbance to generate an empirical approach to estimating functional equivalent units of ideal Florida panther (*Puma concolor coryi*) habitat. The model can be used by permitting agencies to ensure an objective and consistent landscape approach to panther conservation throughout south Florida, and it may be

useful in much of its former range (the southeastern coastal plain of the United States). It is intended for use on lands that are proposed for development as well as for property that could be acquired or otherwise managed to accommodate panther population growth and colonization.

Maehr, D.S. and R.C. Lacy. 2002. Avoiding the Lurking Pitfalls in Florida Panther Recovery. Wildl. Soc. Bull. 30(3):971-978.

Abstract

Forida panther (Puma concolor coryi) recovery currently hinges on the introgression of genetic material from introduced Texas cougars (P. c. stanleyana). Recent population growth has occurred in an area that historically supported fluctuating prey populations. It is likely that local prey populations cannot support increased panther numbers over the long term. In addition, current rates of introgression may result in genetic swamping of the Florida panther. About 50% of the population is composed of individuals with Texas genes, and the entire genomic contribution from Texas exceeds 24%. Strategic removals of genetically intercrossed panthers may be warranted. We recommend caution in claiming success through genetic management, and emphasize the need to take a landscape approach to panther recovery.

Maehr, D.S., E.D. Land, D.B. Shindle, O.L. Bass and T.S. Hoctor. 2002. Florida Panther Dispersal and Conservation. Biol. Conservation 106(2):187-197.

Abstract

We studied dispersal in 27 radio-collared Florida panthers *Puma concolor coryi* in southern Florida from 1986 to 2000. Male dispersal was longer (mean=68.4 km) than that of females (mean=20.3 km), tended to be circular, frustrated, and of insufficient length to ameliorate inbreeding. Females were philopatric and established home ranges that were less than one home range width away from their natal ranges. All females were successful in establishing territories, whereas males were successful 63% of the time. Dispersing panthers avoided moving toward the southeast and into an area of limited forest cover. Independence and the initiation of dispersal occurred at about 14 months of age and lasted for an average of 7.0–9.6 months for females and males, respectively. On average, Florida panthers disperse shorter distances than are typical for western populations of *Puma concolor*. A recent increase in long distance male dispersal events may be related to an increase in reproduction and population density resulting from the introduction of female cougars *P. c. stanleyana* into south Florida. Although the population exhibits the behavioral ability to colonize nearby vacant range, females have yet to do so. Successful dispersal to these areas could be facilitated by habitat restoration and translocation of females.

Maehr, D.S., J.L. Larkin and J.J. Cox. 2004. Shopping Centers as Panther Habitat: Inferring Animal Locations from Models. Ecology and Society 9(2):9.

Abstract

A recent model of Florida panther (*Puma concolor coryi*) habitat erred in arbitrarily creating buffers around radio locations collected during daylight hours on the assumption that study animals were only at rest during these times. The buffers generated by this method likely cause an overestimation of the amounts and kinds of habitats that are used by the panther. This, and other errors, could lead to the impression that unfragmented forest cover is unimportant to panther conservation, and could encourage inaccurate characterizations of panther habitat. Previous 24-hour monitoring of activity and activity readings made during routine telemetry flights indicate that high levels of activity occur in the early morning hours. Literature on the behavior of the species does not support the creation of large buffers around telemetry locations to compensate for the lack of nighttime telemetry data. A thorough examination of ongoing studies that use global positioning systems may help calibrate future Florida panther habitat models.

Maehr, D.S., P. Crowley, J.J. Cox, M.J. Lacki, J.L. Larkin, T.S. Hoctor, L.D. Harris and P.M. Hall. 2006. Of Cats and Haruspices: Genetic Intervention in the Florida Panther. Response to Pimm et al. Animal Conservation 9(2):127-132.

Abstract

The claim that the Florida panther *Puma concolor coryi* has been genetically rescued by the introduction of Texas cougars *P. c. stanleyana* is based on the questionable development and interpretation of a maximum likelihood model, data dredging and a misleading presentation of historical data. In addition, the claim that Florida panther `hybrids are expanding the known range of habitats panthers occupy and use' is offered in the absence of data or supporting analyses. By (1) ignoring regional differences in habitat quality, (2) ignoring the earlier extinction of the hybrid Everglades population, (3) ignoring the influence of social structure on the relative success of Texas cougars and their offspring, (4) using cursory spatial analyses of panthers before and after intervention and (5) choosing a second-best model, a misleading scenario was presented. Undoubtedly hybrid animals have increased in abundance and distribution on the south Florida landscape, but it is quite possible that current patterns of abundance and distribution would be similar if purebred Florida panthers had been introduced instead of Texas cougars in 1995. This is because all the demographic events that have occurred since genetic intervention in 1995 can be more reasonably explained by factors relating to panther social structure and habitat variability. We are hopeful that the current genetic management effort will contribute to the recovery of this endangered population; however, it is too early to claim that this intervention has succeeded or failed. We suggest a number of ways in which more reliable insight on this issue might be obtained.

Maehr, D.S., M.J. Kelly, C. Bolgiano, T. Lester and H. McGinnis. 2006. Eastern Cougar Recovery: Lessons from the Florida Panther. Page 148 in H.J. McGinnis, J.W. Tischendorf and S.J. Ropski editors. Proceedings of the Eastern Cougar Conference 2004, Morgantown, West Virginia, USA.

Abstract

The eastern cougar (Puma concolor couguar) has maintained a remarkable presence despite its presumed extinction—it continues to be the widespread subject of speculation and debate. Here, we expand on the recommendations of Cardoza and Langlois (2002) for a science-based approach to eastern cougar investigations and suggest that recovery efforts on behalf of the Florida panther (P. c. coryi) are far from trivial to the return of the cougar in the East. If recovery can be accomplished in Florida, where a population already exists and is making spectacular efforts to escape the boundaries of constrained space, it will be the precedent needed to drive the human-assisted return of the eastern cougar. Without this step, it will be too easy for unmotivated agencies and a misinformed public to deny the ecological and sociological benefits of restoring populations of large carnivores by correctly observing that if it can't be done in Florida, it can't happen anywhere in the East.

Magnus, L.T. 1956. Mountain Lion Observation in Lake of the Woods County. Flicker 28(1):43-44.

A mountain lion was observed 8½ miles south of Williams, Minnesota on March 12, 1954. Upon investigation by game wardens, a trail of pug marks were visible in the snow and it appeared that the cat had tried to catch a snowshoe hare. Measurement of tracks in the snow were 4½" by 4½" with a couple being wider than long and tail drag marks were also visible. It was determined that the animal was a mountain lion, due to the evidence and because the crusted snow was thick, and only a heavier animal (much heavier than a lynx) could have broken through.

Maletzke, B.T., G.M. Koehler and R.B. Wielgus. 2008. Cougar Spatial and Habitat Use in Relation to Human Development in Central Washington. Page 112 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

In recent decades, residential development has been increasing and human-wildlife interactions are becoming more common. We captured and collared 42 cougars (*Puma concolor*) from 6 weeks old to adult age and monitored their movement patterns and their spatial organization from 2001-2008 in the foothills of the North Cascades near Cle Elum, WA. We fitted cougars >2 years of age with Lotek 4400 and Televilt GPS collars programmed to collect 4-6 location fixes per day all year. We have accumulated over 27,500 locations fixes from 21 cougars. Relative to other areas in Washington, Cle Elum has a lightly hunted cougar population. We found the resident adult cougars were on average >6 years of age. Male cougars we have monitored have scars from fighting, most likely from defending territories from other sub-adult or resident cougars. Home range boundaries appear stable. When a cougar is killed, the next cougar to occupy that area maintains similar home range boundaries and movement patterns. In Kittitas County, there are relatively few

human/cougar incidents as Washington Department of Fish and Wildlife receives approximately 4-11 reports per year and only a small portion are verified as cougars. Preliminary analysis of several individual cougars collared for >4 years display a shift in cougar movements and a withdrawal from areas of large-scale development. Understanding how cougars utilize areas where human development is expanding in cougar habitat may offer tools for managers to potentially minimize human/cougar conflict.

Maliepaard, H.S. 1971. A Report on Wildcats in Saskatchewan. In: Jorgensen, S.E. and L.D. Mech (eds.), 1971. 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. Pages 38-44.

Very little is known in the province. The cougar was not covered by either the Fur or Game Act and therefore received no protection. Information which is available was provided by Mr. Tom White, a private individual who has recorded and investigated observations of cougar in the province. Some of Mr. White's views are presented in this paper, but are provided in more detail in the summaries of papers presented by Mr. White himself. This author did not necessarily agree with the authenticity of all the observations of Mr. White, but felt that the cougar was rare but does exist in small numbers in the central and northern part of the province and may at times move along some of the major watersheds in the South. The last specimen was trapped in 1948.

Mallory, F.F., R.A. Carter, I.S. Kenn, L. Weis and B. White. 2007. The Cougar in Ontario: Myth or Reality. Page 10 in Abstracts of Presentations of the 3rd Midwestern-Eastern Puma Conference, Trent University, Peterborough, Ontario.

Abstract

The present distribution of the cougar (Puma concolor) in North America is restricted mainly to the mountain ranges in western Canada and southeastern United States, primarily in Florida. Recent evidence from 1992 has suggested that cougars occur in New Brunswick and the presence of cougars in Ontario has been controversial, as an abundance of sightings have been reported for many decades, but confirmation has been confounded by a lack of physical evidence (DNA, bodies etc.). The objective of this study was to collect potential cougar scats and other tissue samples from across Ontario and test them for authenticity at the Wildlife Forensic DNA Laboratory, Trent University, Peterborough, Ontario. A total of 12 samples (7 scats, 1 bone and 4 hairs) were analyzed for mt DNA using the QIA amp (Qiagen) extraction protocol and the fluorometer-based picgreen assay for quantification using an amplified region of the cytochrome b gene. The results indicated that of the 11 samples, one was positive for cougar from the WainFleet Bog Conservation Area, Port Colborne, Ontario. Other species identified included canids, lynx and beaver.

Manfredo, M.J., H.C. Zinn, L. Sikorowski and J. Jones. 1998. Public Acceptance of Mountain Lion Management: A Case Study of Denver, Colorado, and Nearby Foothills Areas. Wildl. Soc. Bull. 26(4):964-970.

Abstract

We propose that information about public attitudes toward mountain lion (Puma concolor) management practices is most useful when it accounts for the specific context of human-mountain lion encounter situations. A mail survey was used to assess public acceptance of 4 management actions involving mountain lions in 4 encounter situations occurring at 2 types of locations. Results showed strong support for the hypothesis that acceptance of management actions depends on the specific circumstances of the situations. We suggest that mountain lion management policies should account for a range of contingencies and that future studies of attitudes toward management actions should consider the importance of attitude specificity.

Mann, T. 1959. The Phantom of Elk Mountain. South Dakota Cons. Digest 26(1):2-5.

The last mountain lion recorded in South Dakota was killed in 1930 near the head of Stockade Creek. A fresh lion track was found in the snow at the head of Barrel Spring Canyon and was pursued by hounds. The author and a companion witnessed the lion jump from a ledge just below the rim rock about 30 feet onto a bedded down doe where the lion broke

the neck. The dogs treed the lion and the author killed the 140 pound, 5 year-old tom.

Mansfield, K.G. and E.D. Land. 2002. Cryptorchidism in Florida Panthers: Prevalence, Features, and Effects of Genetic Restoration. J. Wildl. Dis. 38(4):693-698.

Abstract

The overall prevalence of cryptorchidism in Florida panthers (*Puma concolor coryi*) from 1972-2001 was 49% (24/49), with a significant increase over time. The earliest age at which descent of both testicles was known to occur was 2 mo and the latest was 10-13 mo. Delayed testicular descent was documented in 23% (8/35) of juveniles examined. Most retained testicles were in the inguinal canal. There was no apparent difference in reproductive success between cryptorchid and normal panthers, although no bilaterally cryptorchid panthers were known to have sired litters. Cryptorchidism was thought to be a manifestation of inbreeding and was one of several factors that led to the development of a genetic restoration plan whereby eight female puma from Texas were released into the panther population in 1995. None of the progeny resulting from genetic restoration efforts has been cryptorchid. This report provides evidence that cryptorchidism in panthers is genetically rather than environmentally based, and demonstrates the utility of genetic restoration for eliminating certain deleterious traits that result from inbreeding.

Mansfield, T.M. 1986. Mountain Lion Management in California. Trans. 51st N.A. Wildl. and Nat. Res. Conf. Pgs. 178-182.

This paper reviews the history of mountain lion management in California from the early 1900's, with emphasis on legal status, statewide population estimates, depredation problems and public attitudes. Current research and future management options are also discussed.

Mansfield, T.M. 1988. Legal Challenge to Mountain Lion Hunting in California. Pg. 42 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.

Mountain lions (Felis concolor) were hunted in California prior to 1972 under a series of designations including game mammal. Lions have not been legally hunted in the state since 1972. On January 1, 1986, statutes prohibiting lion hunting expired and game mammal status was restored. The Fish and Game Commission directed the Department of Fish and Game to evaluate a range of options related to sport hunting of lions and provide it with alternatives by January 1987. Six alternatives were considered. As required by the California Environmental Quality Act (CEQA), potential impacts associated with the proposed action were considered under a functional equivalent procedure rather than an environmental impact report. The regulatory process was initially challenged in 1987 by coalition of six environmental/animal protection organizations in the San Francisco Superior Court. Although the Court found that there was substantial evidence upon which to base the regulation, it concluded that the Commission had failed to make required findings related to the cumulative effects of the proposed action. In April 1988, the Commission adopted a hunting regulation providing for the take of up to 190 lions in four areas during a 79-day season. A detailed environmental document was prepared which considered, among other things, the cumulative effects of the proposed action. The matter is currently in litigation. This paper reports on the major issues involved in the case and the strategy used by the Commission in responding to the legal challenge.

Mansfield, T.M., and R.A. Weaver. 1988. The Status of Mountain Lions in California. Pgs. 15-18 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 mountain lion was classified as a bountied predator in 1907 and continued until 1963. Over 12,500 lions were taken during the 56 year program which averaged 223 per year. In 1963, the lion was designated a nongame mammal and in 1969 gained game mammal status. Two years of regulated sport hunting followed in which 4,953 tags were sold and 118 mountain lions were taken until a moratorium on lion hunting was legislated in 1972. This moratorium lasted until 1986 and limited sport hunting was proposed in 1987 and 1988, but court challenges prevented their implementation. It was estimated that in 1988, California had a statewide population of 5,100 occupying a minimum range of 80,000 square miles.

Densities ranged from less than one per 100 square miles in southeastern deserts to more than 10 per 100 square miles in portions of the west slope of the Sierra Nevada. Departmental procedures for managing depredating lions are described. Since 1971, the number of lions killed under depredation permits has tended to double every 5 years. Departmental research efforts on mountain lions are discussed.

Mansfield, T.M., R.A. Weaver. 1989. The Status of Mountain Lions in California. Trans. of the Western Section of the Wildlife Society 25:72-76.

The status of mountain lions (Felis concolor) in California is a controversial issue. Field studies of mountain lion populations have been conducted by the Department of Fish and Game and other researchers since 1972. Recent statutory changes, including designations ranging from game mammal to specially protected mammal and an emotional public, have added to the bio-political complexity of lion management. Field studies have recently been expanded through an increased research budget in an effort to improve knowledge of lion ecology. A statewide map of consistently occupied lion habitat has been developed. Mountain lion population densities have been estimated in major geographic regions. A population model is briefly described which was developed and used to evaluate biologically conservative harvest rates in four areas. Data summarized from studies in seven counties were generated using radio telemetry techniques. Habitat and track survey procedures were used to complement information obtained from captured lions. Conflicts between mountain lions, livestock, domestic pets, managed wildlife populations and public safety were identified. Despite a systematic approach to develop biologically sound alternatives for mountain lion management, sport hunting of lions was prohibited by the courts in 1987 and 1988, based on the California Environmental Quality Act. Management options and future constraints are discussed.

Mansfield, T.M. 1990. Politics and Animal Damage Control: The California Lion Case. Page 38 In: Predator Management in North Coastal Ca.: Proceedings of a Workshop Held in Ukiah and Hopland, Ca., March 10-11, 1990 (G.A. Giusti, R.M. Timm, and R.H. Schmidt, eds.). Univ. of Ca., Hopland Field Station Public. 101.

Management of predatory wildlife in California has long been a controversial issue. In recent years public concern has been focused on both the species and the control methods used. Coyotes, mountain lion, and black bear cause considerable damage to property annually. Despite a tendency for the number of confirmed damage incidents caused by lions to double every 5-6 years, politics, rather than objective information, has shaped some laws and policies related to controlling lion damage. During the period 1985-1988, an average of 132 confirmed damage incidents occurred and 55 lions were taken annually. Control of wildlife damage is conducted pursuant to state laws and regulations adopted by the Fish and Game Commission. In recent years, county governments have influenced animal damage control efforts by adopting ordinances which restrict the use of traps. A statewide initiative slated for the June 1990 ballot would specifically prescribe the methods for taking mountain lions causing damage. Both damage control efforts and sport hunting of lions were challenged in court by animal protection groups. It is anticipated that state and federal agencies responsible for animal damage control programs will continue to receive political pressure in California. This paper examines the politics of mountain lion damage control in California.

Mansfield, T.M. 1991. Mountain Lion Damage to Property in California. Pgs. 75-78 In: Mountain Lion-Human Interaction Symposium, C.E. Braun (ed.), Col. Div. Wildl., Denver. 114pp.

Management of predatory wildlife in California has long been a controversial issue. In recent years, public concern focused on the species and the control methods. Coyotes (Canis latrans), mountain lions (Felis concolor), and black bears (Ursus americanus) cause considerable damage to property annually. Despite a tendency for the number of confirmed damages caused by mountain lions to double every 6 years, political processes, rather than objective information, have shaped the laws and policies for controlling mountain lions. From 1985 to 1990, an average of 143 confirmed damages occurred and 56 mountain lions were killed annually. Control of damage by wildlife to property is conducted pursuant to state laws by the legislature and regulations by the Fish and Game Commission. In recent years, county governments have influenced control of damage by animals with ordinances that restrict the use of traps. In June 1990 voters passed a statewide initiative that specifically prescribed the methods for taking mountain lions that cause damage. The initiative prohibits the use of snares and public hunting of mountain lions, and designated the species a specially protected mammal. Damage control and sport hunting of mountain lions have been challenged in court by animal protection groups since 1986. State and federal agencies responsible for animal damage control are expected to continue receiving political

pressure in California.

Manville, R.H. 1951. Reports of Cougar in New York. J. Mammal. 32:227.

Apparently the chief strongholds in New York were in the Adirondack and Catskill Mountains. Between 1871 and 1897, the state of New York paid $2140 in bounties on 107 cougars. A panther was reported in the autumn of 1935 at Bear Mountain by several members of the Trailside Museum staff.

Manville, R.H. 1955. Report of Deer Attacking Cougar. J. Mammal. 36(3):476, 478.

An unidentified camper observed a mule deer doe launching a vigorous attack on a cougar while he was fishing at Redrock Lake, Glacier National Park, Montana, on July 1, 1954. The doe leaped into the air several times and landed with all 4 hooves on the prostrate cat. The cat then jumped to safety into a tree 7 feet above where the attack had occurred. On July 13, another camper reported seeing what appeared to be a cougar in the same general area.

Martın, F.M. and L.A. Borrero. 1997. A Puma Lair in Southern Patagonia: Implications for the Archaeological Record. Current Anthropology 38(3):453–461.

In summary, the authors report that under a given set of conditions pumas can transport bones to protected places under a rock roof. These remains are often but not necessarily associated with plant bedding. Differences in exposure of the place selected for a den permit or inhibit the preservation of the bone assemblage. Other archaeological correlates of the presence of pumas include bones from scats, which may be recognizable under magnification, since signs of digestive corrosion are clear. Then, even when the scats are destroyed, evidences of their former presence can be recorded.

Martin, H.D., D.D. Lewis, S.L. Lin and E.R. Jacobson. 1985. Gastric Mast Cell Tumor in a Cougar. J. Am. Vet. Med. Assoc. 187(11):1258-1260.

A 9-month-old cougar was presented which developed vomiting and anorexia and showed signs of pain upon abdominal palpation. On the fourth day after the onset of the illness, the cougar was tilting its head to the left with ventroflexion of the neck and continued to show pain upon abdominal palpation and a firm mass was found in the right cranial quadrant. Radiography found a radiodense mass in the cranial abdomen, caudal to the liver. A diagnosis of thiamine deficiency accounted for the head tilt and therapy for the treatment of this and the mast cell tumor are presented in detail.

Martorello, D.A. and J. Pierce. 2003. Criteria Used to Implement Public Safety Cougar Removals with the Use of Dogs. Page 71 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

Documented cougar (Puma concolor) complaints have increased significantly (P = 0.03) in Washington State, with approximately 2,900 human-cougar encounters from 1995-99. In 1999 the Washington State legislature passed a law reinstating the use of dogs, which was banned by Voter Initiative in 1996, to address public safety concerns related to cougar. Prior to implementing the law, the Washington State Fish and Wildlife Commission was required to adopt conditions warranting the use of dogs. At the direction of the Commission the Washington Department of Fish and Wildlife (Department) developed a public safety cougar removal recommendation for their consideration. The objectives of that recommendation were to 1) develop a predictive model identifying Game Management Units (GMUs) with a high probability of serious human-cougar encounters and 2) develop a cougar removal level (quota) that would significantly decrease cougar density in those GMUs prone for complaints. We divided all human-cougar encounters from 1998-99 into two categories: category 1 (i.e., human attacks, human-cougar incidents, human-cougar chance encounters, and pet or livestock depredations) and category 2 complaints (i.e., cougar sightings and nuisance activities). To identify GMUs with a relatively high probability of human-cougar interactions, we compared the observed level of category 1 complaints to the expected level if complaints were evenly spaced across all GMUs. We defined chronic complaint areas as those GMUs with statistically more category 1 complaints than expected (P < 0.01). We then used regression tree analysis to identify thresholds of variables that best predicted chronic category 1 complaint areas. We used program PUMA to simulate the

affects of various removal levels on population growth over time to select a removal level (and associated permit levels) which would substantially reduce population size. PUMA model input parameters were estimated from cougar studies in Washington or peer-reviewed literature sources. Regression tree analysis identified the number of previous year category 1 and 2 complaints as the best variables for predicting future category 1 complaint levels. Moreover, the model identified >4 category 1 complaints and >7 category 2 complaints as the levels best predicting chronic areas. Finally, results from PUMA analysis indicated that permit levels designed to remove approximately 30% of the animals in selected GMUs may be necessary to substantial reduce cougar population size over time. The model provides wildlife managers with an example of developing objective criteria for removing cougar due to human safety concerns. We discuss some strengths and weaknesses of the public safety cougar removal model and the corresponding public perceptions.

Martorello, D.A. and R.A. Beausoleil. 2003. Characteristics of Cougar Harvest With and Without the Use of Dogs. Pages 129-135 *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

Prior to 1996, dogs were used to harvest the majority (99%) of cougar during recreational hunting seasons in Washington State. However, in 1996 Voter Initiative 655 banned the use of dogs to aid in the harvest of cougar. As a result, harvest methods shifted to spot and stalk, predator calling, and incidental encounters between deer and elk hunters and cougar. We examined the sex and age structure of harvested cougar and compared these data between seasons with (selective harvest) and without the use of dogs (non-selective harvest). We detected a significant increase in percent female cougars in the total harvest, from 42% to 59% during selective versus nonselective seasons ($T = -7.85$, $P < 0.0001$). We also found that non-selective harvest seasons had significantly more juvenile male ($X^2 = 98.1790$, d.f. = 10, $P < 0.0001$) and female ($X^2 = 66.5116$, d.f. = 10, $P < 0.0001$) cougars compared to selective seasons. We then used program RISKMAN to evaluate the potential impacts to population growth (finite rate of increase) from changes we observed in harvest vulnerability of specific sex and age classes. Our sensitivity analysis suggests that changes in female adult and cub survival are the most influential parameters to population growth and the increased harvest of female cougars in non-selective harvest methods decreased the finite rate of increase by about 0.01–0.02. Harvest methods that increase the relative harvest vulnerability of these cohorts have a greater potential for impacting population growth. In Washington State, the current level of cougar harvest and increased vulnerability of females and juvenile cougar have likely increased the risk of impacting population growth.

Maser, C., and R.S. Rohweder. 1983. Winter Food Habits of Cougars from Northeastern Oregon. Great Basin Nat. 43(3):425-428.

Sixty-four cougar (Felis concolor) stomachs and 41 intestinal tracts were examined for food items in northeastern Oregon from 1976 through 1979. Food items, in order of decreasing frequency, were mule deer (Odocoileus hemionus), North American elk (Cervus elaphus), porcupine (Erethizon dorsatum), snowshoe hare (Lepus americanus), and deer mouse (Peromyscus maniculatus).

Maser, C., and D.E. Toweill. 1984. Bacula of Mountain Lion (Felis concolor), and Bobcat (Felis rufus). J. Mammal. 65(3):496-497.

Thirteen male Felis concolor, collected between 1978 and 1982 in Oregon, were examined for the presence of bacula. Three adult females were also examined for the presence of os clitoris, but none were found. Bacula were present in 10 of 13 (77%) male mountain lions. Bacula were 6.9 ± 1.9 (range 3.9-10.2) in greatest length and 4.4 ± 1.8 (range 1.8-7.2) in greatest width. Viewed dorsally, the distal portion of bacula of mountain lions were conical and slightly flattened dorsoventrally, similar to those of Felis domesticus. Proximal portions were variable but normally showed flattened lateral processes. In cross-section, bacula of mountain lions were nearly flat. Despite wide intraspecific variation, position of proximal lateral processes on the baculum shaft and pattern of lateral process development may be useful in comparative taxonomic studies among the Felidae.

Mattson, D.J., J.V. Hart, P. Beier and J. Millen-Johnson. 2003. A Conceptual Model and Appraisal of Existing Research Related to Interactions Between Humans and Pumas. Page 104 *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

Recorded encounters between humans and pumas have been increasing throughout the western contiguous U.S., as have puma-caused human injuries and deaths. We developed a conceptual model of interactions between humans and pumas to aid the design of a study in the Flagstaff uplands of Arizona, USA, and to appraise the scope and strength of existing related research. The model represents contact and resulting human injuries as the outcome of 2 processes: (1) the frequency of encounter between humans and pumas, and (2), given an encounter, the probability that it will turn injurious to a human. Conceptually, different suites of factors govern these 2 phenomena. The model representing frequency of encounter includes 15 putative explanatory variables, 7 of which relate directly to pumas. The model representing probability of injury also includes 15 explanatory variables, 7 of which pertain directly to pumas. The remaining variables in both models relate directly or indirectly to human presence or behavior. Of the 44 identified relations among these variables, 6 have been well studied and an additional 18 have been subject to some level of systematic analysis. The remaining 20 relations, including many plausibly critical ones, are currently informed only by speculation, anecdote, or deduction. Much research yet needs to be done before the level and nature of contact between humans and pumas can be adequately explained and predicted. Moreover, much of this additional research needs to address human behavior and factors related to distributions and numbers of humans. Of the uninvestigated factors with plausibly major effects, habituation of cougars promises to be the most difficult to study. Otherwise, numbers and distributions of human facilities (including roads and trails), puma population sizes, human behavior, and human knowledge of pumas are potentially important explanatory factors amenable to inquiry. We argue that all of these putative effects should be considered before reaching conclusions about the “causes” of human-puma encounters and puma-caused human injuries, whether for a region or a given study area.

Mattson, D., J. Hart and T. Arundel. 2005. Cougar Predation in the Flagstaff Uplands: Preliminary Results from Julu 2003-May 2005. Pages 158-169 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

Predation rates and prey composition are relevant to judging effects of cougars *(Puma concolor)* on ecosystems. Radiocollars that frequently obtain and satellite-transmit GPS locations provide researchers with unprecedented opportunities to collect sustained reliable information on cougar predation. We fitted 7 cougars (3 adult males and 4 adult females) in the Flagstaff uplands of Arizona with Telonics GPS/Argos radiocollars and collected information from 115 kills made by these animals between July 2003 and May 2005. We also obtained a comprehensive record of movements based on 4-hour-interval GPS locations from collars deployed on and dropped by 2 adult males and 2 adult females. Overall, 45% of kills were elk *(Cervus elaphus),* 34% were deer *(Odocoileus* spp.), and 21% were smaller mammals. Elk <1-year-old comprised the largest single category of kills (25%). Compared to adult females, adult male cougars killed more elk (71% versus 38%) and fewer small mammals (3% versus 34%). Two female cougars killed a total of 18 mesocarnivores (28% of all female kills), of which 16 were coyotes *(Canis latrans)*. Almost all kills (93%) occurred between 1700 and 1100 hours and were most frequent (69% of kills) between 2100 and 0500 hours. The probability that large prey (adult deer and elk calves or larger) had been killed exceeded 0.50 when a cougar was more-or-less stationary for >39 hours. The probability that no kill had occurred exceeded 0.50 when a cougar was stationary for >4 but <22 hours. Considering only large prey, intervals between kills were 7.8 and 9.9 days for the 2 adult males and 12.1 and 15.6 days for the 2 adult females. Including small prey, intervals for the females were 6.7 and 8.4 days. Mean time spent consuming large prey was 2.4 and 3.4 days for the male cougars and 4.3 days for both female cougars. The females averaged 1.3 and 1.6 days consuming small prey. Our future objectives for this study include collecting more of the types of information summarized here as well as an analysis of habitat features associated with successful predation.

Mattson, D., T. Arundel and J. Hart. 2005. Cougar-Informed Spatial Frames and Control for Autocorrelation in Analyses of Habitat Selection. Page 216 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

Researchers have long struggled with a conceptual basis for specifying spatial frames for analyses of habitat selection. The long-standing issue of control for spatial autocorrelation has also been exacerbated by newly available short-interval GPS animal locations. We developed an approach to specifying spatial frames and controlling for spatial autocorrelation based on measures of performance for models of habitat selection that used all available data. We first determined 50, 67, 75, 90, 95 and 99% quantiles of distances between GPS locations obtained at 4-hour intervals for individual cougars radiocollared in the Flagstaff uplands of Arizona. We buffered each cougar location by radii corresponding to each quantile and randomly located a paired point within each different-sized buffer. Each cougar location and random point was attributed with explanatory variables, including terrain roughness index, elevation, habitat cover type, distance to nearest road and distance to nearest water source. We specified logistic regression models for each variable, a different model each for random points from the different buffer sizes. We used area under the Receiver Operating Characteristic curve (ROC), R^2, and Akaike's Information Criterion (AIC) to determine which model corresponding to which buffer size best discriminated between random points and cougar locations for each variable. By inference, the buffer size associated with the best model represented the spatial scale at which cougars were maximally discriminating for the corresponding variable. This scale varied among cougars, variables, and seasons, suggesting that there was no single best spatial frame for specifying the extent of "available" habitat for cougars, although all best models used random points from quantiles >90%. We controlled for spatial autocorrelation by using values of each variable that were lagged 1-10 time steps prior (i.e., auto logistic regression). We only used values from prior steps 1, 4, 7, and 10 (4, 16, 24, and 40 hours prior) to minimize effects of collinearity among explanatory variables. Correlations among lagged variables dropped below 0.2 within 3 time steps, hence the 3-step interval between lagged variables. Almost all best models included values from at least 1 prior time step.

Mazzolli, M. and C.B. Ryan. 1997. Contributions To The Identification of *Puma concolor concolor*. Pages 46-53 *in* W.D. Padley, ed., Proc. Fifth Mountain Lion Workshop: 27 February- 1 March 1996; San Diego, California.

The identity of mountain lion subspecies in Brazil is yet to be studied. The most controversial subspecies is *Puma concolor concolor* which inhabits semi-arid regions as well as Atlantic forests and savannas. The range of *P.c. concolor* has changed three times since the first description. The range now extends from northeast Brazil south through Uruguay to northeastern Argentina and Paraguay. Up till now the subspecies description of *P.c. concolor* has been based on three skulls: one male from northeastern Brazil; and a male and female from southeastern Brazil. The purpose of this paper is to identify variations within the range of *P. concolor* and provide information for further studies on the taxonomy of Brazilian mountain lions. Such information may be valuable to define management plans for the species at the subspecific level. Twenty-nine skulls (15 male and 14 female) from two regions within the range of *P. c. concolor* were compared. Differences are reported on measurements of both males and females.

Mazzolli, M., C.B. Ryan, and M. Graipel. 1997. Effects and Patterns of Mountain Lion Predation of Livestock on Small and Medium Sized Properties in Santa Catarina, Brazil. Pages 54-61 *in* W.D. Padley, ed., Proc. Fifth Mountain Lion Workshop: 27 February- 1 March 1996; San Diego, California.

The effects of mountain lion predation on livestock from 15 different farms were analyzed. Surveys were done from 1993 through 1995. The effects of predation are weighed against losses to other factors. The patterns of predation were recorded when possible, including period of day, frequency during the year, climate and livestock management.

Mazzolli, M. M.E. Graipel and N. Dunstone. 2002. Mountain Lion Depredation in Southern Brazil. Biol. Conservation 105(1):43-51.

Abstract

Mountain lion (*Puma concolor*) depredation incidents on livestock herds were recorded at 15 ranches in southern Brazil from 1993 to 1995. Maximum losses to mountain lions were 78% for goats, 84% for sheep, and 16% for cattle. Cattle mortality arising from causes other than depredation assumed a greater importance in herd productivity. In contrast, attacks on sheep and goats were more frequent than losses to other causes, but could be reduced to acceptable levels when flocks were corralled at night. Most depredation incidents occurred when weather and light conditions were

unfavorable to human activity. We explain these patterns and inter-ranch variation in depredation rates on the basis of a risk-avoidance strategy by the mountain lions. Stock losses can be minimized by understanding these patterns and by applying appropriate herd husbandry, thus reducing the urge to persecute this protected species.

Mazzolli, M. 2003. Prey Items of Mountain Lions in a Forestry System in Brazil. Page 72 *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) scats were collected during two years in a forestry system in Brazil. One hundred and fifty scats were analyzed, revealing that nine-banded armadillo, peccaries, and brocket deer accounted for the bulk of the diet of mountain lions in the area.

Mazzolli, M. 2003. Density and Resilience of Mountain Lions in a Forestry System in Brazil. Page 72 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

Density of mountain lions (Puma concolor) based on tracks discrimination and camera-trap photography was estimated in a 100 km^2 area embedded in a larger 1,255 km^2 property intensively managed for timber extraction. Additionally, over 300 fixes were obtained from a radio-tracked female mountain lion during seven month yielding information on activity patterns near villages, paved roads, and other disturbances. Results reveal a healthy mountain lion and prey base population, suggesting that commercially productive forestry systems can become suitable habitats when straight-forward management strategies are implemented.

Mazzolli, M. 2003. Relationships Between Land Tenure System, Mountain Lion Protection Status, and Livestock Depredation Rate. Page 105 *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 lion depredation impact on managed livestock in ranching-dominated landscapes was compared with depredation in forestry-dominated landscapes. In forestry dominated landscapes, twenty-one depredation incidents were recorded at three ranches, resulting in the loss of 58 sheep and goat. An additional 11 head were killed during an unknown number of attacks. These losses amounted to 14 to 60 percent of total stock per year (in number of animals). Confining or corralling flocks during the night at first provoked a reduction of livestock depredation, but subsequently depredation begun to occur during daylight. In the ranching-dominated landscape, on the other hand, depredation losses were not reported on flocks corralled during the night, but reached 85% of the total stock when free-ranging. I hypothesize, based on field data and on available information in literature, that mountain lion depredation in forestry areas during the day and higher depredation on corralled livestock during the night may result from lower hunting pressure on mountain lions than in ranching areas. Understanding mountain lion predation behavior may help to modify livestock husbandry, allowing wildlife managers and ranchers to minimize depredation without direct persecution of mountain lions.

Mazzolli, M. & L.A. Hammer. 2007. Studying Jaguars, Pumas and Their Prey in Brazil's Atlantic Rainforest: The Jaguar Corridor. Expedition Report. Biosphere Expeditions, UK. 54pp.

Abstract

Expeditions to the southern Atlantic forest of Brazil were conducted with local students in August 2006 and Biosphere Expeditions in November 2006. They aimed to elucidate the current habitat conditions for jaguars and pumas, based on parameters collected from field sampling. Parameters collected were species richness for mammalian communities over 1 kg and proportion of area occupied (PAO) by jaguar and pumas (ocelot PAO was also calculated) in 8 quadrats 2 x 2 km over an area of 130 square kilometers. Species richness was estimated using CAPTURE software, and PAO was estimated using PRESENCE software. Fourteen species of mammals were recorded (R) in total, and the same number of species was estimated (N ˆ) by CAPTURE: Agouti *Dasyprocta azarae*, two species of brocket deer *Mazama* spp.,

capybara *Hydrochaerus hydrochaeris*, capuchin monkey *Cebus nigritus*, crabeating fox *Cerdocyon thous*, howler monkey *Alouatta guariba*, jaguar *Panthera onca*, nine banded armadillo *Dasypus novemcinctus*, ocelot *Leopardus pardalis*, peccary (inc. sp.), puma *Puma concolor*, racoon *Procyon cancrivorous*, and tapir *Tapirus terrestris*. Capture probabilities calculated from PAO were very high for puma (p=1) and very low for ocelot (p=0.15, SE=0.08) and for jaguar (p=0.1, SE=0.07), resulting in estimated PAOs of 25% for puma and 100% for both jaguar and ocelot. In other words, puma was easy to detect when present, so its PAO was the same as the 'naïve' PAO, i.e. the product of the number of quadrats where the species was found by the total number of quadrats sampled. Jaguar and ocelots were considered by PRESENCE, based on accumulated data, extremely difficult to detect even when present so that occupancy estimates presumed that they must be everywhere. Puma was recorded only by tracks, jaguar by vocalisation and tracks, and ocelot by tracks and camera traps. It is argued here that jaguar were expected to have similar capture probabilities than puma, as they share the same habits of walking on open trails and being fairly easy to detect, provided the area is suitable for track imprinting. For this reason the high PAO was likely to be an artifact derived from the low area fidelity, and low density of jaguars in the area, rather than a product of its low detection probability. This conjecture is substantiated by the low frequency and non-detection of important prey species in many of the sampled quadrats. Only three species (deer, armadillo, and ocelot) were recorded during 351 camera trap nights, and frequency of tracks was equally low, including those of vulnerable prey that are generally easily detected when present such as peccaries and tapir. Species richness, presence of puma, and presence of vulnerable prey were higher further from human settlement. Low presence of vulnerable prey are certainly a product of human poaching and may be indirectly responsible for the reduced presence of jaguars in the area. The area is crossed by trails used for illegal extraction of palm heart resulting in extensive areas where adult palm stands are simply absent, and where poaching is likely to occur causing a reduction of wildlife populations. The problems connected with illegal palm heart extraction are also the ones connected to illegal (and mostly unrecorded) poaching. It is important in this context to mention that this does not diminish the importance of the study site for jaguar conservation, as it is part of one of the few remaining blocks of connected jaguar habitat in the Atlantic evergreen forest. Instead, these observations identify management needs for these areas could be upgraded from corridors to full habitats if prey species were given opportunity to prosper.

Mazzolli, M. & L.A. Hammer. 2007. Habitat Suitability for Jaguar and Puma in Southern Atlantic Forest of Brazil Inferred from Proportion of Area Occupied and Prey Richness. Wild Felid Biology and Conservation Conference. WildCru, Oxford.

Abstract

Two month-long expeditions to the southern Atlantic forest of Brazil were conducted in 2006. Parameters collected from vestiges and camera-trap sampling were mammalian prey richness and proportion of area occupied (PAO) by jaguar and pumas. Eight quadrats 2 x 2 km were sampled, over an area of 130 square kilometers, where fourteen species of mammals were recorded (CI (N^)=14 to 14, CAPTURE). Capture probabilities from PRESENCE were high for puma (p=1), but low for ocelot (p=0.15, SE=0.08) and for jaguar (p=0.1, SE=0.07), resulting in estimated PAOs of 25% for puma, and 100% for both jaguar and ocelot. It is argued that jaguar were expected to have capture probabilities similar to puma, as they both leave signs on open trails when present. The resulting jaguar PAO is thus likely to be an artifact derived from low area fidelity and/or low density, rather than a product of its low detection probability of the species. This conjecture is substantiated by the low frequency and non-detection of important prey species in many of the sampling quadrats. Results do not diminish the importance of the study site, instead, these observations objectively identify the need to restore prey populations in the area.

Mazzolli, M. 2010. Mosaics of Exotic Forest Plantations and Native Forests as Habitat of Pumas. Environmental Management 46(2):237-253.

Abstract

There is a general lack of information on the impact of forest plantations and the presence of urban settlements on populations of resource-demanding species such as large felids. To partially address this problem, a project study was conducted to find out whether mosaics of forest plantations and native vegetation can function as an adequate habitat for pumas (*Puma concolor*) in southern Brazil. The study was conducted within a 1255-km^2 area, managed for planted stands of *Pinus* spp. and *Eucalyptus* spp. Individual identification of pumas was carried out using a combination of track-matching analysis (discriminant analysis) and camera-trapping. Both techniques recorded closely similar numbers of individual pumas, either total (9-10 individuals) or resident (5-6 individuals). A new approach, developed during this study, was used

to individualize pumas by their markings around the muzzle. The estimated density varied from 6.2 to 6.9 individuals/100 km^2, ranking among the highest across the entire puma range and indicating a potential total population of up to 87 individuals in the study site. In spite of the availability of extensive areas without human disturbance, a radio-tracked female used a core home range that included forest plantations, an urbanized village, and a two-lane paved road with regular vehicular traffic. The high density of pumas and the species' intensive use of modified landscapes are interpreted here as deriving from conditions rarely found near human settlements: mutual tolerance by pumas and humans and an adequate habitat (regardless of plantations) largely due to the inhibition of invasions and hunting and maintenance of sizable extents of native forest patches. More widely, it suggests the potential of careful management in forestry operations to provide habitat conditions for resource-demanding species such as the puma. Furthermore, it highlights the importance of curbing invasions and hunting, in this case provided by the presence of company employees, for the maintenance of wildlife populations.

McAdoo, J.K. and D.A. Klebenow. 1978. Predation on Range Sheep with No Predator Control. J. Range Manage. 31(2):111-114.

Losses of open range herded sheep were monitored in areas about 32 km northwest of Bridgeport, California, and 14 km southwest of the Nevada State line between June 8 and September 29, 1976. Organized predator control had not been employed for the previous nine years. Of 59 verified predator losses, 53 (90%) were from coyotes (Canis latrans), 1 (2%) from bobcat (Lynx rufus), and 5 (8%) were from unknown species of predators. Although mountain lions (Felis concolor) and black bears (Ursus americanus) were present on the study area, no depredations were verified.

McBride, R.T. 1976. The Status and Ecology of the Mountain Lion, Felis concolor stanleyana, of the Texas-Mexico Border. M.S. Thesis, Ross State Univ., Alpine, Texas. l60pp.

SUMMARY

An extensive study of the southwestern mountain lion (Felis concolor stanleyana) was conducted over the range of the animal in Texas and the Rio Grande border in the Republic of Mexico. Elevations within the study area ranged from sea level to 10,000 feet and habitat included tropical lowlands, alpine forests, and desert mountains and bolsons. Over 160,000 square miles of lion country were surveyed to determine population numbers. Lions were increasing in Texas due to a decline in control caused by the removal of sheep from the major part of the lion's range. In Mexico, lion numbers were decreasing due to habitat destruction. It is estimated that the lion population in Texas presently numbers between 200-250, with 75% of those occurring in Trans-Pecos Texas. Radio telemetry studies (1972-1976) indicated that lions are extremely wide ranging predators, able to exist and reproduce at very low population densities. No evidence of territoriality was found in these lions, but a tendency of mutual avoidance is evident. The role of scrapes as a means of communication between lions is discussed. From data acquired in this study, it seems that lions can be transplanted successfully, thereby opening up possibilities of removing them from localities where they are causing a problem and relocating them in distant areas where the potential problem does not exist. This would open the door to their re-establishment in states or national parks where their habitat exists, and they could perform their natural function as a predator on wildlife populations. For example, the recovery team for the Florida panther has considered the introduction of Texas lions into Florida. Food habits and prey preference data were taken by examination of scats and stomach analysis. Lions were found to prefer deer even when scarce and also an almost total abstinence from rodents was noted with the exception of porcupines. Physical data of lions and methods employed by lions in stalking and killing prey were taken from 18 years of field notes, dating back to 1957, compiled while I was employed as predatory animal hunter for the Bureau of Sport Fisheries and Wildlife and under private employment by livestock growers in Mexico. Lions are seldom seen and generally observed by their tracks and scrapes. Their possibility as a game animal in Texas is limited, and predation of livestock causes lions to be regarded by most landowners as a destructive and potentially dangerous animal. It was determined that the natural function of mountain lions to deer herds is population suppression and not the culling of sick or weak animals. To ensure the continuance of a healthy lion population in Texas that can be enjoyed both for its sporting potential and esthetic value, a management plan must encompass a recognized need for their control when necessary, and protection in other instances. It remains a challenge for wildlife biologists to develop a plan that will utilize the lion as a potential asset to the management of game, an income to the landowner, and to the esthetic value of an animal that certainly belongs in the scene of Texas wildlife.

McBride, R. 1980. Report on Mountain Lion Survey, Guadalupe Mountains National Park. National Park Service Spec. Rep., 3pp.

Sign of mountain lion was surveyed in portions of Guadalupe Mountains National Park from March 19-22, 1980. At least 3 lions were in the park during the survey and this number would never exceed five or six adults at any time. Mountain lions were known to be in the Delaware and Eagle Mountains south of the park, and north of the park in the Guadalupe Mountains.

McBride, R.T. and T.K. Ruth. 1988. Mountain Lion Behavior in Response to Visitor Use in the Chisos Mountains of Big Bend National Park, Texas. Final Report. Ranchers Supply, Inc. Prepared for USDI, National Park Service. Santa Fe, New Mexico. 37pp.

An increase in mountain lion (Felis concolor)/human encounters has been documented over the past several years in Big Bend National Park. Due to several close encounters involving injuries to humans, the National Park Service funded research to document mountain lion behavior in response to changes in visitor use in the park. Movements and behavior of seven radio collared mountain lions were monitored around trails, areas of heavy visitor use, and areas of light visitor use from October 1987 through September 1988. Mountain lions often used trails as travel corridors and passed close to campgrounds and campsites during nightly movements in the Chisos Mountains. Daytime bedsites of mountain lions were situated in relatively close proximity to trails on several occasions without incidents with humans. Heavy periods of visitor use were documented during the Thanksgiving, Christmas, and Spring Break/Easter holidays; however, no significant changes in mountain lion behavior occurred during these periods. Linear regression analysis of mountain lion distance to the closest trail and visitor use of the trail for that day indicated that no correlation existed between the two ($y = .8099 + .0881 x$; $r^2 = .000336$). Mountain lion activity periods were most likely to overlap with human activity periods between 0700 and 1100 hours, and 1600 to 2100 hours. Lion activity appears more closely associated to activity periods of prey. Mountain lions that appear to fit into a classification of individuals that may pose a threat to humans were predominantly dispersal age, subadult lions. Suggestions are made for an interim management protocol for dealing with problem lions.

McBride, R. T. 1993. Do Mountain Lions Exist in Arkansas? Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 47:394-402.

Abstract

Surveys covering over 1,161,140 ha in Arkansas from 1988-1991 revealed abundant sign of several native and domesticated mammal species, but none from the mountain lion (Felis concolor). Because of our intensive methodology and the equivocal nature of previous documentation, we suggest there are no wild, reproducing populations of mountain lions in Arkansas. Extensive forests in the state, however, may provide suitable habitat for mountain lion reintroduction experiments.

McBride, R. 2003. The Effects of Predator Control on Mountain Lions in Texas. Page 72 *in* L. A. Harveson, P. M. Harveson, and R.W.Adams, eds. Proceedings of the Sixth Mountain Lion Workshop. Austin. Texas.

Abstract

Predator control has played a more significant role than habitat loss in the density and distribution of mountain lions (Puma concolor stanleyana) in Texas. They have historically been viewed as a problem animal, especially by the sheep industry. Early predator control efforts were conducted mainly by ranchers, but the federal government played an increasing role as the sheep industry expanded westward. Catch records beginning in the 1930s indicate that mountain lion populations remained low in Texas. In fact, by 1960, there were probably less than 30 residents in the state. Even this small population was under intensive pressure for removal that would have been accomplished had there not been dispersers from Mexico. Following a severe drought in the 1950s, the sheep industry vacated a large portion of the Trans-Pecos. They left behind permanent water, an abundant mule deer herd, and a reduced need for predator control. These factors provided fertile conditions for the recolonization of mountain lions, which they quickly seized. During the next 30 years, the population reached record numbers and expanded its range into areas that had been vacant for decades. Currently, the mountain lion population in west Texas is maintaining its distribution but the density has declined since a peak in the 1980s.

Reasons for this decline include a precipitous drop in the mule deer herd and a resurgence of predator control. Mountain lions in Texas will continue to persist with or without legal protection as long as their habitat remains intact.

McBride, R., D.K. Jansen, R. McBride and S.R. Schulze. 2005. Aversive Conditioning of Florida Panthers by Combining Painful Experiences with Instinctively Threatening Sounds. Page 136 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

Following the groundbreaking genetic restoration program that began in 1995, the documented Florida panther *(Puma concolor coryi)* population has tripled. This increase has escalated the probability for conflicts between panthers and humans. In 2004, 2 such complaints involving public safety were reported. Because the Florida panther is an endangered species, removal of the offending animal was not a preferred option. Therefore, an effective method to aversively condition panthers was needed. To meet this need, we developed a 3-stage aversive conditioning program and tested it in 2004 on 4 Florida panthers involved in the 2 complaints. Stage 1 involved treeing with hounds, tranquilizing, and fitting panthers with radio transmitters. Stage 2 reinforced this initial aggravation by treeing the panthers with hounds when they were in the vicinity of the complaint. The panthers were then provoked into leaving the tree, while restraining the hounds from further pursuit. This allowed the panthers to escape. Stage 3 simulated these previous uncomfortable experiences by approaching the panthers while broadcasting taped recordings of the same hounds. These aversive conditioning techniques resulted in varying responses on the part of the panthers. It appears that some degree of avoidance and fear of humans can be instilled in panthers when combining instinctively threatening sounds such as baying hounds with reinforcement by painful experiences.

McBride, R.T., R.T. McBride, R.M. McBride and C.E. McBride. 2008. Counting Pumas by Categorizing Physical Evidence. Southeastern Naturalist 7(3):381-400.

Abstract

The occurrence of *Puma concolor* (Cougar) can be confirmed by detecting physical evidence (i.e., tracks, urine markers). However, determining the number of pumas responsible for creating this sign is problematic. We addressed this difficulty by categorizing physical evidence (sign) and applied this method during the *Puma concolor coryi* (Florida Panther) project. Three rules were used to distinguish individuals. (1) Gender was determined by track size or stride length; (2) time (freshness) was determined by known events within the past 24 hours, such as wind or rain; and (3) distance between individual track sets was used as an exclusionary tool to avoid over-counting. We evaluated accuracy by capture and by comparison to 3 other indices. This method can be adapted to count other large felines.

McBride, R.T., R.T. McBride, R.M. McBride and C.E. McBride. 2008. Censusing Pumas by Categorizing Physical Evidence. Page 185 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 occurrence of *Puma concolor* can be confirmed by detecting physical evidence (i.e. tracks, urine markers). However, determining the number of pumas responsible for creating this sign is problematic. We addressed this difficulty by categorizing physical evidence (sign) and tested our method during the *Puma concolor coryi* (Florida panther) project. Three rules were used to distinguish individuals. (1) gender was determined by track size or stride length; (2) time (freshness) was determined by known events within the past 24 hours such as wind or rain; (3) distance between individual track sets was used as an exclusionary tool to avoid overcounting. We verified accuracy by capture and comparison to 3 other indices. This method could be adapted to census other large felines.

McBride, R. and C. McBride. 2010. Florida Panther Flehmen Response Recorded at Baited Trail Camera Site. Southeastern Naturalist 9(3):629-631.

Abstract

Although flehmen behavior is reported in felids, this display has been rarely documented in wild pumas. On 11 Nov. 2008, we recorded a female Puma *concolor coryi* (Florida Panther) exhibiting the flehmen response and scent marking in reaction to a baited trail camera site in Everglades National Park. The addition of scent lures to our camera sites increased the number of exposures per panther visit, enhancing the possibility of gender identification, an essential component of our annual survey.

McBride, R. and C. McBride. 2010. Predation of a Large Alligator by a Florida Panther. Southeastern Naturalist 9(4):854-856.

Abstract

Alligator mississippiensis (American Alligator), ranging in size from 45.7–152.4 cm, have been identified as a *Puma concolor coryi* (Florida Panther) prey species. On 14 March 2008, we discovered a 269.2-cm Alligator that was killed and fed upon by a male Panther; this record is the largest one reported to date.

McCabe, R. A. 1949. The Scream of the Mountain Lion. J. Mammal. 30:305-306.

This account supports the contention that the mountain lion definitely screams or that it may even be said to roar. The observations took place in the Sierra Madre at an elevation of 5800 feet, seven miles southwest of Colonia Pacheco, Chihuahua, Mexico.

McCain, E.B. 2008. Daily Activity Patterns of Mountain Lions (*Puma concolor*) in Relation to the Activity of Their Prey Species in Southern Arizona. M.S. Thesis. Humboldt State University, Natural Resources: Wildlife.

Abstract

Food resources are not evenly distributed over space or time, and therefore, changes in prey abundance and availability may influence predator behavior both spatially and temporally. It has been suggested that mountain lions (*Puma concolor*) follow the daily activity patterns of their main prey species. In the Sonoran Desert the javelina (*Pecari tajacu*) is an important prey item for mountain lions and it has been shown that javelina shift from a diurnal activity pattern during winter months to a nocturnal pattern in the summer. I examined whether mountain lions shift their activity patterns between summer and winter following the activity of the javelina. Alternatively, I examined whether mountain lions shifted their diet to other species that were more active during the period when mountain lions were active. I analyzed 117 mountain lion fecal samples to determine their diet during summer (16 April–15 October) and winter (16 October–15 April) and I used the date/time stamps from 4,528 trail-camera photographs collected during March 2001-September 2006 in southern Arizona to index daily activity patterns of mountain lions and their prey species. Mountain lions did not track the activity of one particular prey species, but appeared to shift their daily activity patterns and diet according to temperature and availability of different prey species in a given season. Coues white-tailed deer (*Odocoileus virginianus couesi*) were the most common prey in both winter and summer, but the mountain lion diet was supplemented with seasonally abundant and vulnerable domestic calves (*Bos taurus*) in summer and javelina in winter. Because mountain lion activity patterns and their diet both changed between winter and summer, it was difficult to discern exactly what drove these seasonal shifts. High temperatures may have influenced mountain lions to shift towards nocturnal activity in the summer. Coues white-tailed deer remained primarily diurnal through the summer, while the excessive daytime temperatures may have limited mountain lion movements and reduced their ability to exploit this resource. The occurrence of deer in mountain lion diet decreased in summer, and cattle increased. With the cooler daytime temperatures and the absence of calves of domestic cattle in the winter, mountain lions became more diurnal, which coincided with the activity of Coues white-tailed deer and javelina, both of which became more prevalent in the mountain lion diet at that time.

McCarthy, D., M. Cuthill, T. Bartnick, D. Reed, H. Quigley and D. Craighead. 2008. Intra-specific Variation in Cougar

Behavior in the Southern Greater Yellowstone Ecosystem. Page 251 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

Cougar behavior, as well as mammal behavior, is considered to be relatively static in terms of the social interactions, social tolerance, and spacing behavior. However, this lack of variation may be a reflection of the lack of intensive research. New technology for tracking cougars and other wildlife has provided opportunities to document more fully the interactions between cougars. We present several examples of how intensive, day-to-day tracking and new technology have provided documentation of heretofore little-documented behaviors for cougars. We provide evidence for cougar interactions gathered in the southern greater Yellowstone ecosystem. For example, a female cougar and her male kitten visited her adult offspring and kittens in the summer of 2006 and the two family groups spent several days together. The adult cougar and kittens were visited while feeding on an elk by an adult male; the two adults and three kittens apparently tolerated each other at the kill site. The adult male and the three kittens were captured and collared at that site. After the adult female was legally harvested, her three large kittens (approx. 14 mo. of age) traveled with a family group of an adult female and three kittens of approximately 6 months of age. These types of intra-specific behaviors, although uncommon, may change the understanding of cougar social interactions and spacing behavior.

McCauley, M.N. 1977. Current Population and Distribution Status of the Panther, Felis concolor, in Florida. M.A. Thesis. Univ. S. Florida, Tampa. 58pp.

One hundred fifty published and 391 unpublished Florida panther records were examined for data on distribution, habitat, foods, home range, reproduction, mortality, and activity. Unpublished records were assigned to one of four reliability categories based on the kind and amount of supporting evidence and the qualifications of the observer. Panthers are found in every major terrestrial habitat type in the state and show no strong habitat preference. White-tailed deer and feral hogs, supplemented by other mammals, birds, and reptiles, appear to form the major part of the panther's diet in Florida. Reproduction apparently occurs year-round, with a possible peak in February. Shooting and highway deaths are the major known sources of mortality. Panther population concentrations presently appear to exist in Everglades National Park in Dade and Monroe counties, the Myakka River Valley in Sarasota and Manatee counties, the Fakahatchee Strand in Collier County, and Gulf Hammock in Levy County. Other areas that appear to have established populations include Fisheating Creek Wildlife Management Area in Glades County, O'Leno State Park in Columbia County, Blackwater River State Forest in Santa Rosa and Okaloosa counties, Lake Kissimmee State Park in Polk County, Loxahatchee National Wildlife Refuge in Palm Beach County, and the vicinity of Highlands Hammock State Park in Highlands County. Based on the number and distribution of recent records, the current total Florida panther population may consist of as many as 300 animals throughout its entire range in the southeastern United States, with possibly 100-200 individuals in Florida.

McCown, J.W., D.S. Maehr, and J. Robosky. 1990. A Portable Cushion as a Wildlife Capture Aid. Wildl. Soc. Bull. 18:34-36.

Safe capture and handling techniques are essential to research goals and to the endangered population of 30-50 individual panthers in Florida. A portable, inflatable cushion is described which cost $600 (materials and labor) in 1988. Methods of cushion deployment are described with assembly requiring from 15-20 minutes. From January 1986 through November 1988, 18 captures of 13 panthers were made. The cushion was deployed 14 times and falls were cushioned on 9 occasions with panthers lowered by rope a total of 5 times. Weights of captured panthers ranged from 14 to 73 kg. Heights at which panthers treed varied from 4 to 17 m (mean=7.7, SD=3.3).

McCown, J.W. 1991. Big Cypress Deer/Panther Relationships: Deer Herd Health and Reproduction. Final Report. Study No. 7508, Fed. No. E-I II-E-5a. Florida Game and Fresh Water Fish Commission. 75pp.

White-tailed deer (Odocoileus virginianus) track counts, observations, and a fall collection of doe deer were utilized to compare deer herds inhabiting Florida panther (Felis concolor coryi) habitat in the Bear Island (BI) and Corn Dance Units (CDU) of Big Cypress National Preserve (BCNP), Fakahatchee Strand State Preserve (FS), Florida Panther National Wildlife Refuge (PR) and Collier Enterprise (CE) lands. Necropsies were used to obtain standard body measurements, kidney fat indices (KFI's), amounts of fat on the tail, kidney, pericardiac lining and heart, abomasal parasite loads, inter-

uterine fecundity and physical condition. Although the FS herd increased during the study, deer in FS, CDU, and PR were less numerous than deer in BI. Deer in FS and CDU had lower KFI's, tail fat and physical condition values than deer in BI, PR, and CE. Deer from FS and CDU had fecundity rates less than 1.0 fawns per adult female while females from other areas produced more than 1.0 fawns per adult female. There was an inverse relationship between physical condition and abomasal parasite counts.

McCulloch, C.Y. and R.L. Brown. 1986. Rates and Causes of Mortality Among Radio Collared Mule Deer of the Kaibab Plateau, 1978-1983. Final Report. Proj. No. W-78-R, Wk. Pl. 2, Job 18. Arizona Game and Fish Dept., 37pp.

During the 1970's there was a decline in the numbers of mule deer which summer on the Kaibab Plateau. The decline halted and reversed concurrently with a decrease in mountain lion (Felis concolor) numbers and the development of a long wet spell which generally improved deer food production. In addition to drought and lions there were unknowns, possibly coyotes (Canis latrans) and/or hunter crippling and poaching, which also contributed importantly to the high mortality rate of does in 1972-1976. None of these factors have been critical since 1979, as evidenced by low mortality of radio collared does and the pellet count index of an increasing deer herd. Numbers of cattle which share the deer food supply were greater before than during this study. Associations of female deer losses and mortality with annual fluctuations of weather, buffer species, and other environmental conditions appeared generally weak and complicated. Drought appropriate for these kinds of tests did not occur during the study.

McDonald, K.P. 1991. Utah Cougar Harvest 1990-91. Annual Perf. Rep., Proj. No. W-65-R-D-39, Job A-7, Public. No. 91-16. Utah Dept. Nat. Res., Salt Lake City. 21pp.

RESULTS

Cougar harvest permits were purchased by 383 resident and 142 nonresident hunters. The total of 525 permits was the maximum number which could be purchased and the same number was purchased the year before. Completed questionnaires were returned by 435 of the 525 permittees who were mailed one and represented a 83.3% response rate. Hunters spent an average of 8.5 days afield resulting in 4,069 hunter days. A summary of statewide cougar harvest statistics for years 1970-91 is provided. A total of 265 cougars were harvested and an additional 36 cougars were taken by Animal Damage Control agents, and 2 were killed by livestock owners whose animals were being killed. Twenty-two additional mortalities included road kills (8), illegal kills (6), nuisance kills (4), and natural causes (4) also occurred. Adult male cougars accounted for 54.3% of the kill, adult females (17.4%), subadult males (15%), and subadult females (13.2%). Hunter success increased to 55%, the highest it had been since 1978. Cougars were treed by hunters an estimated 1,436 times for an average of 3.6 cougars treed per hunter and 0.35 cougars treed per hunter-day. A total of 364 pursuit permits were issued. Questionnaires were also mailed to them with a 85% return rate. An estimated 3,511 cougars were treed during 7,172 pursuit-days for an average of 10.4 cougars treed/pursuer and 0.49 cougars treed/pursuit day. A cougar pursuit questionnaire summary is provided for years 1978-79 to 1990-91.

McGinnis, H. 1982. On the Trail of the Pennsylvania Cougar. Pennsylvania Game News 53(2):2-8.

Most zoologists assumed that the cougar had been extirpated from the East by 1900 except in Florida. The author knew of no more than 5 cougars taken in the state before 1900 which are now in museum and private collections. The last cougar was shot in Berks County in 1874. Reports of cougar have never stopped but no physical evidence has been provided except for one debated case. On October 28, 1967, John Gallant killed a young female mountain lion in Crawford County and a larger one that was with it got away. It is possible that they were escapees from captivity.

McGinnis, H.J. 1982. Reports of Cougars in Pennsylvania Since 1890. Unpublished Report. Rt. 2, Box 530, Edwards, MS 39066. 73pp.

Two hundred ninety-two individual reports of alleged sightings and kills of cougars and "black panthers" in Pennsylvania between 1891 and 1981 were rated plausible. Although the study did not involve serious field work, effort was made to locate physical evidence of cougars recorded by others. Eight casts/photos of alleged cougar tracks were identified as dog or bear. I speculate that Pennsylvania has a small breeding population of cougars, descended partially from survivors of the 19th century population, partially from occasional escapes/releases of captives, and perhaps more recently from

immigration from MD, VA, and WV. The opinion that cougars do not occur in the state and people's inability to identify sign may be partially responsible for the lack of concrete evidence.

McGinnis, H.J. 2006. Southern Mississippi Field Test of Two Approaches for Determining the Presence or Absence of Pumas in the East. Pages 94-99 in H.J. McGinnis, J.W. Tischendorf and S.J. Ropski editors. Proceedings of the Eastern Cougar Conference 2004, Morgantown, West Virginia, USA.

Abstract

A total of 135 miles of dirt roads and spoil areas within an area of approximately 143 square miles within and around the Stennis Space Center in Hancock County, Mississippi were searched for puma (Puma concolor coryi) tracks during 1987. Some of the road surfaces were not suitable for tracking, but segments showing animal tracks were searched repeatedly. No puma tracks were found, but 30 track sets of bobcat (Lynx rufus) and other species were noted. Not enough miles were searched to be 95% certain pumas do not occur in Hancock County. However, the bulk of the evidence suggests that Hancock County does not support a breeding population of pumas. The study demonstrates the difficulty of determining the absence of a species with a high level of confidence.

McGrath, K.A. 1988. Human-Lion Encounters in Boulder County, Colorado. B.S. Thesis, University of Colorado, Boulder. 18pp.

Between January and April of 1986, 82 human-lion encounters were recorded in Boulder County. Specific details included elevation of sighting, time of day, season of year, length of encounter and description of topography around the site. A band of elevation between 5000-8000 feet encompassed the majority of the interactions. Within this band, many reports occurred in areas of low road density, in times close to dusk and dawn, and in seasons of fall and winter. Encounter reports have increased dramatically within the last decade. A growing deer population and prime lion habitat close to the city limits suggest that human-lion encounters may continue to increase.

McIvor, D.E., J.A. Bissonette and G.S. Drew. 1995. Taxonomic and Conservation Status of the Yuma Mountain Lion. Cons. Biol. 9(5):1033-1040.

Confusion persists over the taxonomic status of and viability of the Yuma mountain lion (*Felis concolor browni*). We conducted a review of the literature on lions in the American Southwest and interviewed resource and public-land managers and wildlife researchers to help us understand the current status of the Yuma mountain lion. We also contacted museums and assembled the most complete set of morphometric data on the Yuma mountain lion. Few if any breeding female lions, a paucity of prey, and a lack of suitable habitat within the reported range of this population cast doubt on its status. We conclude that the subspecific status is probably not warranted.

McIvor, D.E. and J.A. Bissonette. 1997. Assessing Subspecies Status: A Holistic Evaluation of the Yuma Mountain Lion. Pages 62-68 in W.D. Padley, ed., Proc. Fifth Mountain Lion Workshop: 27 February- 1 March 1996; San Diego, California.

Recent consideration of the Yuma mountain lion as a potential Threatened or Endangered species prompted us to examine the evidence supporting this population's designation as a subspecies. We took a holistic approach, examining taxonomic and ecological data and all published references to the subspecies. Currently available data casts the subspecific status into doubt. Existing data are inadequate for a rigorous morphometric comparison between this and surrounding populations, but we conclude C.H. Merriam's original basis for designating the Yuma mountain lion as a subspecies was incorrect.

McKay, A. 1974. The Panther... Still Roaming? Adirondack Life 5(I):18-21, 44-47.

The author spotted a panther in the Adirondacks and snapped a photograph of the animal in August, 1972. A photograph cannot be considered documentary evidence of the presence of panthers and only the fresh skin of a specimen can. The Eastern Panther (F.c. couguar) became a federally protected animal on June 1, 1973. The largest known Adirondack specimen was killed by Verplank Colvin and weighed two-hundred pounds. The largest North American specimen weighed 276 pounds and measured 8 feet 7-3/4 inches. Only three stuffed animals, two incomplete skins, and seven

skulls of Adirondack panthers are known to science. Between 1871 and 1884, forty-six skins were bountied for 20 dollars each. It was estimated that about 100 had been killed between 1860 and 1884, and panthers were scarce by 1885. The last panther was bountied in 1894 and since this time it has been considered extirpated, despite reports of sightings.

McKee, D. 2003. Cougar Attacks on Humans: A Case Report. Wilderness and Environmental Medicine 14(3):169-173.

Abstract

Cougar attacks on humans are increasing. Presented is a case report of a nonfatal 2-year-old male cougar attack on an 8-year-old girl in British Columbia. Discussions of wound management, rabies postexposure prophylaxis (RPEP), and the possible psychologic ramifications of such an attack are presented. Also reviewed are recommendations on actions that may be helpful in preventing an attack following a sudden encounter with a cougar. Humans must learn to coexist with cougars, which present a small but real threat to people.

McKinley, D. 1961. The Mountain Lion. A History of Missouri's Big Cat. Bluebird 28(4):6-12.

SUMMARY & DISCUSSION

Hardly any large wild animal could have been more reported and less seen, in earlier times as well as today, than the mountain lion in Missouri. The confusion over just what kind of animal, or how many species was being dealt with, the awesomeness with which it was invested and the blame for livestock destruction that was- just or not- laid to its discredit, all left their impressions on the historical record. Except for often somewhat questionable county history records, few reports on the mountain lion have been uncovered. From a perusal of bounty laws one sees that "wolves" were much more worried about than lions. In fact, it appears that only the Territorial bounty law, in effect about 14 months in 1817-1818, even mentioned panthers ($2.00 for the scalp of a panther over six months of age if taken within 10 miles of a settlement; to be paid in a "wildcat certificate" which could be used as regular money (Missouri Laws, 1:490-491, 562). Perhaps they never were common. Only a few reports carry the animal's history as late as 1840 in northern Missouri; there are observations, some of them good, for southern Missouri at later dates. The undoubted record for southeast Missouri in 1927, as well as several rumors, even into the 1950's, may come from widely wandering individuals from other states.

McKinney, T., T.W. Smith and J.C. Devos Jr. 2005. Changes in Mountain Lion (*Puma* concolor) Diets Following Increased Harvest of the Predator and Removal of Cattle. Page 152 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

We studied mountain lion (*Puma concolor*) diets in association with increased sport harvest of the predator and removal of cattle in the Sonoran Desert of central Arizona from 1999 to 2003. Diets shifted from initially about equal use of biomass of large (cattle, collared peccary [*Pecari tajacu*], deer [*Odocoileus* spp.], desert bighorn sheep [*Ovis canadensis*] and small prey (rabbits and rodents) to predominantly large wild prey, particularly collared peccary, and diet diversity declined >50%, following increased mountain lion harvest and removal of cattle. Reduced intraspecific interference and higher ratios of large prey per predator ostensibly might explain observed changes in mountain lion diets.

McKinney, T., J.C. Devos Jr., W.B. Ballard and S.R. Boe. 2006. Mountain Lion Predation of Translocated Desert Bighorn Sheep in Arizona. Wildl. Soc. Bull. 34(5):1255-1263.

Abstract

We analyzed data for 422 unmarked and 369 radiocollared desert bighorn sheep (*Ovis canadensis*) translocated into vacant historical habitats in 12 Arizona locations between 1979 and 1995. We evaluated factors potentially influencing predation of radiocollared desert bighorn sheep by mountain lions (*Puma concolor*) by determining relationships between predation rates, number released, size of releases, escape terrain, available terrain (escape terrain as a percentage of area with slopes ≥40%), habitat quality associated with release locations, and mule deer (*Odocoileus hemionus*) and predator abundance. We hypothesized that numbers of radiocollared animals released, quality of habitat and available

terrain associated with release locations, and relative abundance of mule deer influenced predation of translocated desert bighorn sheep by mountain lions.

McKinney, T. and S. Poppenberger. 2008. Distribution and Movements of Mountain Lions Associated with Human Residential/Urbanized Areas in North-Central Arizona. Page 110 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

Sightings and other encounters between humans and mountain lions have increased in western North America during recent decades, particularly near and within residential/urbanized areas. How the predator uses these areas is poorly understood. We present findings of research between January 2005 and September 2007 regarding distributions and movements of mountain lions within wildland and residential/urbanized habitats in north-central Arizona. We captured 16 adult (≥2 years old) mountain lions from hunted populations by trailing them with hounds or using leg-hold snares. We attached radiocollars with GPS receivers to mountain lions captured within ≤10 km of human residential/urbanized developments to estimate overlap of distributions and movements with these areas. Receivers were programmed to attempt position fixes every 7 hours, and monitoring durations of individual mountain lions ranged between 1 and 22 months. Success of attempted GPS position acquisitions was about 75%. Four mountain lions occupied only wildland habitats. Distributions and movements of 12 overlapped with residential/urbanized areas; <1 to >96% of total GPS location fixes acquired for individuals occurred within these areas. Human developments and residences encroach on mountain lion habitat, and our findings suggest that mountain lions do not necessarily avoid entering residential/urbanized areas. We hypothesize that mountain lions might enter such areas frequently, just travel through them, explore them briefly and leave, or inhabit them extensively. Humans may encounter mountain lions comparatively infrequently, even when distributions and movements of the predators overlap extensively with areas of residential/urbanized developments.

McKinney, T., T.W. Smith and R.B. Waddell. 2009. Rates of Survival and Sources of Mortality of Cougars in Hunted Populations in North-central Arizona. The Southwestern Naturalist 54(2):151-155.

Abstract

Estimating rates of survival of cougars (*Puma concolor*) and identifying sources of mortalities potentially enhance management prescriptions. Sport hunting is believed to be the primary cause of mortality in hunted populations of cougars, but little research has evaluated how hunting and other causes of death might influence survival and sources of mortality of these predators in semi-arid ecosystems. We captured and monitored 16 adults (12 males, 4 females) during 2006 and 2007 on two heavily hunted, semi-arid, study areas in north-central Arizona. Rates of survival of adults differed moderately between study areas and years, generally were =0.67, and were comparatively low for combined years (=0.55). One-half of radiocollared adults died during the study, and sport hunting was the primary cause of deaths, followed by intraspecific aggression and collision with vehicles. We hypothesize that sport hunting was the primary factor influencing relatively low rates of survival of cougars on the study areas.

McLaughlin, C.R. 2003. Utah Mountain Lion Status Report. Pages 51-59 *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 have been managed as a protected game species in Utah since 1967. In 1999 the Division of Wildlife Resources completed the Utah Cougar Management Plan, developed with the assistance of a public-based Cougar Discussion Group that will guide management of cougars through 2009. Cougar harvests are managed under both harvest objective (quota) and limited entry strategies. The Division manages to sustain cougar densities on all management units except those that have approved predator management plans, where cougar harvests are increased to reduce cougar numbers and predation on big game. All cougar complaints are handled under the guidance of a Nuisance Cougar Complaints policy. Most cougar conflicts are handled through lethal control. Cougar habitat encompasses about 92,696 km^2 (35,790 mi^2). The statewide population was estimated at 2,528-3,936 cougars in 1999 in conjunction with the Cougar Management Plan. Cougar harvests have ranged from 492 to 373 annually since the 1997-1998 season. Both the hunting

and pursuit seasons run from mid-December through June, although some units have extended or shortened seasons. Cougars have been implicated in 74-114 separate depredation incidents per year since 1998, with livestock losses ranging from $53,700 to $97,700 per year. Harvest-based indicators of sustainable harvesting have not been met in recent years. Currently, management is operating on an individual-unit scale, where interpretation of harvest data is hampered by small sample sizes. In addition, the Division should develop a means to monitor both reproduction and survival. Harvest management should improve with understanding of cougar movements and dispersal, particularly between lightly hunted and heavily harvested cougar populations.

McLean, D.D. 1954. Mountain Lions in California. Ca. Fish and Game 40:147-166.

California paid bounties on 10,558 lions, an average of 240 per year from 1907 to 1950. The population was estimated at 600 adult lions. Kittens retain their spots until about 8 months of age. The walking stride of an adult lion is about 22 inches. Old males have a circuit or beat of 75-125 miles, but often no part of the beat will extend more than nine or ten miles from the center of the lion's range and generally intersects as many female lion ranges as possible. Usually a circuit is completed in less than 10 days and averages about 5 days. Females ordinarily travel in canyons, while males are more likely to be found on the higher ridges. Three distinct types of markings are employed by male lions and there was no evidence to indicate that females ever leave any type of mark. Prey is captured and killed by a skillful stalk to a striking distance of from 20 to 75 feet and the kill is made either by a bite through the back of the neck at the base of the skull or by disemboweling the prey. From 1907 until 1917, a bounty of $20 per lion was paid regardless of sex. From 1917 to 1945, the bounty was $20 for a male lion and $30 for a female. Since 1945, it had been $50 for males and $60 for females. A table is provided which details numbers of bounties paid by county from 1907 to 1950 by the Department of Fish and Game. It appeared that the lion population reacts about 2 years behind the deer, with the lion kill not fluctuating as extremely as the deer.

McLeod, C. 1991. Going, Going, Gone? Nature Canada 20(2):11-12.

An eastern cougar was supposedly spotted and video recorded for 7 minutes in Waasis, New Brunswick in May, 1990. The animal was determined to be approximately 52 to 65 cm long (excluding the tail) and according to wildlife officials could have been either a young cougar or a large housecat. The most recent undisputed sighting was on the Maine/Quebec border in 1938. Since 1977 there had been over 300 sightings of cougars in New Brunswick alone. Naturalists estimated that if the eastern cougar did exist in New Brunswick, the population would not exceed 30 individuals. In 1978, however, the number had risen to 250, based on predator-prey ratios in other areas, especially increasing whitetail deer numbers. Wildlife directors have started a cougar recovery team to investigate reported sightings in the hope of finding proof that cougars are living and breeding in the region.

McMullin, P.F. 1978. A Skeletal Growth Defect in the Puma (Felis concolor). Abstracts of a Symposium on the Comparative Pathology of Zoo Animals, National Zoological Park, Washington D.C.

A young zoo-born puma, with captive-bred parents and two normal litter mates, was found to have marked skeletal abnormalities. These were most obvious in the shortened and laterally deviated fore-limbs. The radiographic changes in the affected animal and the normal appearance of the bones of the litter mates are presented. The affected animal was euthanised for detailed pathological examination, and the gross lesions observed in the bones consisted of retention of unossified blocks of cartilage arising from the growth plate. Routine necropsy procedure demonstrated no further abnormalities. Histopathological examination of tissue from abnormal growth plates confirmed that the basic problem was a greatly reduced rate of conversion of cartilage into bone in certain areas of the growth plate. Staining of non-demineralized sections of abnormal growth plate revealed that this abnormality was associated with reduced calcium deposition and the presence of ferric iron in the matrix of cartilage close to the margin of the plate. The very close pathological similarity between this case and a hereditary disease of the dog (chondrodysplasia of the Alaskan Malamute), the exclusion of the nutritional bone diseases, and the occurrence of other individuals known to have similar bone defects in the pedigree of this animal will be discussed, and found to indicate that this case was probably an example of a hereditary disease of the puma.

McMullin, P.F. 1978. A Skeletal Growth Defect in the Puma (Felis concolor). Vet. Record 103:356-358.

Clinical and radiological signs shown by a young deformed puma cub, and the pathological findings following its euthanasia at eight months, are presented. These findings do not resemble those in the recognized nutritional bone diseases of the growing carnivore, but closely resemble a hereditary disease of the dog and, at least in one respect, a hereditary disease in man. This case may be an example of hereditary chondrodysplastic dwarfism in the puma. An unusual finding was the presence of iron in the cartilage of abnormal growth plates.

McNamee, T. 1981. Chasing a Ghost. Audubon 83(2):30-35.

The last cougar (F.c. couguar) bounty in the East was collected on January 6, 1890 in the Adirondack town of Day, New York. Robert Downing was the leader of a 5-year study funded by the U.S. Fish and Wildlife Service and U.S. Forest Service to search for Eastern Cougar sign and investigate cougar sightings.

McRae, B.H., P. Beier, L.E. Dewald and P. Keim. 2005. Gene Flow Among Mountain Lions in the Southwestern USA. Page 201 *in* R.A. Beausoleil and D.A. Martorello, editors. Proceedings of the Eighth Mountain Lion Workshop, Olympia, Washington, USA.

Abstract

We examined the effects of habitat discontinuities on genetic structuring in mountain lions *(Puma concolor)* across the southwestern USA. Using 16 microsatellite loci, we genotyped 540 mountain lions sampled throughout the states of Utah, Colorado, Arizona, and New Mexico, where a high degree of habitat heterogeneity provides for a wide range of connective habitat configurations between subpopulations. Our analyses revealed genetic structuring at two distinct scales. First, strikingly strong differentiation between northern and southern regions within the study area suggests little migration between them. Second, within each region, gene flow appears to be strongly limited by distance, particularly in the presence of habitat barriers such as open desert and grasslands. Northern mountain lions showed both reduced genetic diversity and greater divergence from a hypothetical ancestral population based on Bayesian clustering analyses, possibly reflecting a post-Pleistocene range expansion. The results presented here build on those of previous studies, and begin to complete a picture of how different habitat types facilitate or impede gene flow among mountain lion populations.

McRae, B.H., P. Beier, L.E. Dewald, L.Y. Huynh and P. Keim. 2005. Habitat Barriers Limit Gene Flow and Illuminate Historical Events in a Wide-Ranging Carnivore, the American Puma. Mol. Ecol. 14(7):1965-1977.

Abstract

We examined the effects of habitat discontinuities on gene flow among puma (*Puma concolor*) populations across the southwestern USA. Using 16 microsatellite loci, we genotyped 540 pumas sampled throughout the states of Utah, Colorado, Arizona, and New Mexico, where a high degree of habitat heterogeneity provides for a wide range of connective habitat configurations between subpopulations. We investigated genetic structuring using complementary individual- and population-based analyses, the latter employing a novel technique to geographically cluster individuals without introducing investigator bias. The analyses revealed genetic structuring at two distinct scales. First, strikingly strong differentiation between northern and southern regions within the study area suggests little migration between them. Second, within each region, gene flow appears to be strongly limited by distance, particularly in the presence of habitat barriers such as open desert and grasslands. Northern pumas showed both reduced genetic diversity and greater divergence from a hypothetical ancestral population based on Bayesian clustering analyses, possibly reflecting a post-Pleistocene range expansion. Bayesian clustering results were sensitive to sampling density, which may complicate inference of numbers of populations when using this method. The results presented here build on those of previous studies, and begin to complete a picture of how different habitat types facilitate or impede gene flow among puma populations.

Mead, J.R. 1898. Felis concolor. Kansas Acad. Sci. 16:278-279.

Mountain lions were occasionally found in central Kansas in its first settlement and were common along the southern line of the state but not as common as in Oklahoma. The author verified that he has heard a panther scream. Panthers

frequently killed and ate Indians' horses and the Indians hunted and killed them with the aid of dogs.

Meagher, M. 1986. Cougar and Wolverine in Yellowstone National Park. Information Paper. National Park Service, U.S.D.I., Yellowstone National Park. 3pp.

A total of 121 cougars were known to have been killed in Yellowstone National Park from 1904 to 1925 during a predator control era. From 1960 through August 1973, 92 reliable reports of cougar (72 sightings of 76 animals, 20 tracks) were made within or immediately adjacent to the park. From 1974 through 1985, 204 reliable reports of cougar (163 sightings of 191 animals; 41 track reports of apparently 48 animals) were received. The increased number of sightings probably reflected monitoring efforts (begun July 1, 1972) and the presence of more park visitors or possibly an increase in the number of cougars utilizing the park and adjacent areas.

Meegan, R.P. and D.S. Maehr. 2002. Landscape Conservation and Regional Planning for the Florida Panther. 2002. Southeastern Naturalist 1(3):217-232.

Abstract

The need for regional planning is increasingly important for effective Florida panther (Puma concolor coryi) (Bangs 1898) conservation and is essential for protecting enough habitat in South Florida to ensure a viable population. We used two decades of radio telemetry data and geographic information system (GIS) software to develop a regional blueprint for landscape restoration that enhances dispersal, facilitates population colonization, and could be the basis for future land use decisions in the range of the endangered Florida panther. We identified 923,576 ha of forests in an 18-county study area that is a barrier-rich patchwork of land uses. A least cost path analysis simulated natural colonization events and can be used to identify landscape linkages and conservation networks for the panther. Our analysis of planned development permits suggests that large-scale land protection must happen quickly. The alternatives are managing an isolated, heavily managed population or large-scale landscape restoration that is probably economically unfeasible.

Mehrer, C.F. 1975. Some Aspects of Reproduction in Captive Mountain Lions, Felis concolor, Bobcats, Lynx rufus, and Lynx, Lynx canadensis. Ph.D. Thesis, Univ. North Dakota, Grand Forks. 142pp.

More than 1500 vaginal smears and 750 urine samples were collected from 18 captive mountain lions, Felis concolor Linnaeus, 17 bobcats, Lynx rufus (Schreber), and 9 Canadian lynx, Lynx canadensis Kerr, from 1973-1974. Four types of epithelial cells were observed in the vaginal smears: parabasal, intermediate, cuboidal superficial and nivicalar superficial. The smears were classified as anestrus, proestrus, estrus or metestrus on the basis of the four cell types and other smear characteristics. The reproductive behavior in captive mountain lions, bobcats, and lynx was also analyzed and the relationship between vaginal smear types and reproductive behavior patterns was determined. The reproductive behavior patterns of the three species were similar to each other and to patterns in the domestic cat, Felis catus Linnaeus, and included stages of anestrus, proestrus, estrus and metestrus. There was a highly significant association ($P < 0.001$) between behavioral patterns and cytological appearance of the vaginal smear at every stage of the estrus cycle for each species. The change in type of vaginal smear, total urinary estrogen excretion and overt behavior were used to monitor seasonal variation in the reproductive cycle of two mountain lions and three bobcats from January 5, 1973 to December 31, 1974. One mountain lion had seven and the other had six estrus periods over the two years. These estrus periods occurred in seven separate months from March through November. However, eight (61%) of the estrus periods occurred from March through June, indicating a seasonal influence on reproduction. The estrus periods averaged 8.1 days in length. Total estrogen excretion during the estrus periods averaged 49.82 mg/12 hour urine sample. The estrus cycle averaged 37.6 days and the estrus cycle averaged 59.5 days in length. Bobcats were observed to be seasonally polyestrus. Over a span of two years, each of the three bobcats had five estrus periods from late March through early August. The estrus periods averaged 7.6 days in length. Total estrogen excretion during the estrus periods averaged 21.41 mg/12 hour urine sample. The estrus cycle averaged 37.3 days in length and the estrus cycle averaged 46.4 days. Mountain lions, bobcats and lynx were injected daily with varying amounts of estradiol benzoate (EB) or pregnant mares serum gonadotrophin (PMSG) for up to 15 days to determine the utility of these hormones in inducing estrus and physiological levels of total estrogen excretion. The change in vaginal smear type and total estrogen excretion over the course of gestation also was determined in three mountain lions. Daily injections of 75-90 mg EB or 80-125 IU PMSG for 15 days were effective in inducing estrus and physiological levels of total estrogen excretion in mountain lions. Daily

injections of 20-30 mg EB or 70-90 IU PMSG for 15 days were effective in bobcats. Daily injections of 20 mg EB or 60-100 IU PMSG for 15 days were effective in lynx. The number of copulations and amount of total estrogen excretion appeared to be important in determining whether breedings resulted in pregnancy. The vaginal smears of the three pregnant mountain lions contained predominantly parabasal cells from the second through the thirteenth week of gestation, except for one week when superficial cells were predominant. Total estrogen excretion was less than 11.0 mg/12 hour urine sample during the first week of gestation and gradually increased to an average of 44.28 mg/12 hour urine during the thirteenth week of gestation. There were minor peaks in total estrogen excretion during the same weeks that superficial cells were predominant. The vaginal smear was not useful in diagnosing pregnancy in the mountain lions.

Meric, S.M. 1984. Suspected Feline Leukemia Virus Infection and Pancytopenia in a Western Cougar. J. Am. Vet. Med. Assn. 185(11):1390-1391.

A 14-month-old western cougar (Felis concolor) was examined that had a history of having collapsed after being lethargic for 24 hours. The cougar was non-responsive to stimuli upon admission and other symptoms and treatment are detailed. The cougar died one hour after admission. Necropsy results are described and were consistent with a diagnosis of FeLV-related leukopenia and thrombocytopenia. Feline leukemia virus and the FeLV-related diseases had rarely been reported in exotic feline species.

Merriam, C.H. 1897. Descriptions of Two New Pumas from the Northwestern United States. Proc. Biol. Soc. Wash. 11:219-220.

One species of puma, Felis hippolestes, from Wind River Mountains, Wyoming; and one subspecies, Felis hippolestes olympus, from Lake Cushman, Olympic Mountains, Washington are described.

Merriam, C. H. 1903. Eight New Mammals from the United States. Proc. Biol. Soc. Wash. 16:73-78.

A new subspecies of cougar, Felis aztecus browni, is described from the desert region bordering the lower Colorado, below Yuma, Arizona.

Merrifield, G.C. 1953. Occurrence of a Mountain Lion in Oklahoma. Proc. Oklahoma Acad. Sci. 34:75.

On March 13, 1953, the author was informed of a very large animal track found in an area southeast of Canton Reservoir, Canton, Oklahoma. Upon investigation, the tracks were found to be spaced approximately 35 inches apart. Dr. Bryan P. Glass of Oklahoma A&M College indicated that the track could only be that of a mountain lion, based on the lack of claw marks and measurements which were taken.

Meschkat, R. S. 1953. The Mountain Lion in Texas. Texas Game and Fish 11(3):24-26.

In the past the puma probably lived in all parts of Texas. Its range has been reduced to such a great extent that it is now usually found only in the more remote areas of south and west Texas, primarily west of the Pecos and along the Rio Grande Rivers. Estimates were made that one lion will kill 50 or more deer a year, or an average of one per week. The author felt that it would be well to tolerate a few pumas on certain remote game ranges to help keep the game animals within desirable numbers.

Miller, A.M., M.E. Roelke, K.L. Goodrowe, J.G. Howard, and D.E. Wildt. 1990. Oocyte Recovery, Maturation and Fertilization In Vitro in the Puma (Felis concolor). J. Reprod. Fert. 88:249-258.

SUMMARY

Eight female pumas were treated i.m. with 1000 (N = 5) or 2000 (N = 3) i.u. PMSG followed 84 h later by 800 i.u. hCC. Eggs were recovered 24-26 h after hCG from ovarian follicles by using laparoscopy and transabdominal aspiration. Mature eggs were inseminated in vitro 4-6 h later whereas immature eggs were cultured for 24 h and then inseminated. Electroejaculates from 3 pumas were diluted with mKRB before insemination to evaluate the influence of sperm

concentration on fertilization. Seven of 8 pumas responded with follicle development, and 140 eggs were recovered from 145 follicles (96.6%; 77 mature, 43 immature, 20 degenerate eggs; mean + or - s.e.m., 20.0 + or - 5.9 eggs/female). Overall fertilization rate was 43.5% (total eggs fertilized = 40) despite using inseminates containing 82-99% pleiomorphic spermatozoa. Of the 36 immature oocytes matured in vitro and inseminated, 12 were fertilized even though 50% of the inseminating spermatozoa contained an acrosomal defect. Fertilization rate of mature oocytes collected from follicles appeared unrelated (P>0.05) to PMSG dose or number of spermatozoa/inseminate. This study demonstrates that a high proportion of follicular eggs can be recovered laparoscopically from adult pumas treated with PMSG and hCG. These gametes are capable of being fertilized in vitro (immediately or after maturation in vitro) even with low quality semen with a high incidence of sperm pleiomorphisms.

Miller, D.L., S.K. Taylor, D.S. Rotstein, M.B. Pough, M.C. Barr, C.A. Baldwin, M. Cunningham, M. Roelke and D. Ingram. 2006. Feline Immunodeficiency Virus and Puma Lentivirus in Florida Panthers (Puma concolor coryi): Epidemiology and Diagnostic Issues. Vet. Res. Commun. 30(3):307-317.

Abstract

This study documents the seroprevalence of feline immunodeficiency virus (FIV) and puma lentivirus (PLV) in free-ranging and captive Florida panthers (*Puma concolor coryi*) (n = 51) and translocated Texas cougars (*P. concolor stanleyana*) (n = 10) from 1985 to 1998. The sera were tested for anti-FIV antibodies by enzyme-linked immunosorbent assay (ELISA) and Western blot tests. The ELISAs were read kinetically (KELA) and the sera were retrospectively examined by PLV peptide ELISA. Eleven panthers and one cougar were positive by KELA; 4 panthers and 4 cougars were equivocal; 35 panthers and 5 cougars were negative; and 1 panther had no data. Seven of the 11 KELA-positive panthers were also positive by Western blot tests and all but one were positive by PLV peptide ELISA. Ten KELA-negative and Western blot-negative cats, were positive by PLV peptide ELISA. KELA results varied within cats from one sample period to the next, but PLV peptide ELISA results were consistent. Territorial sympatry and mating behaviour, noted from radiotelemetry location data on the cats, may have contributed to viral transmission between seropositive animals. These findings suggest that Florida panthers and the introduced Texas cougars have been exposed to FIV and/or PLV.

Miller, R.M. 1968. A Case of Anthrax in an American Mountain Lion. Vet. Med./Small Anim. Clinician 63-952-953.

The author reports a case of a mature young female mountain lion (Felis concolor) which was found dead at a private zoo in Thousand Oaks, California, and brought in for necropsy. The animal was reportedly alert in the morning and was found dead at noon. Two bobcats had died unaccountably two days earlier, but the cause of death had not been determined. Necropsy indicated that the mucous membranes of the mouth and eyes were pale and somewhat cyanotic. The spleen was three to four times normal size, dark in color, and the parenchyma more liquid than normal. Marked enteritis was present and there were endocardial ecchymoses and petechiae. The cervical and submandibular lymph nodes were surrounded by a gelatinous edema and were enlarged and hemorrhagic. The thoracic spine revealed a scoliosis characteristic of a low-calcium rickets and secondary hyperparathyroidism commonly found in Carnivora fed a diet consisting primarily of striated muscle meat. This puma had been fed a diet of beef from dead cattle and at least one rancher in the area neglected to vaccinate his herd which resulted in an outbreak of anthrax. The diagnosis of anthrax was confirmed by means of a bacteriophage test.

Miotto, R.A, F.P. Rodrigues, G. Ciocheti and P.M. Galetti Jr. 2007. Determination of the Minimum Population Size of Pumas (*Puma concolor*) Through Fecal DNA Analysis in Two Protected Cerrado Areas in the Brazilian Southeast. Biotropica 39(5):647-654.

Abstract

Pumas (*Puma concolor*) are an endangered species due to habitat loss and the ever-growing conflict with expanding human populations. We used genetic analysis of feces, a noninvasive study method, to determine the presence of pumas and their estimated minimum population in two protected areas in the northeast of São Paulo State, Brazil: Jataí Ecological Station and Vassununga State Park. We were able to identify the species that originally deposited the feces by means of amplification of a portion of the mitochondrial cytochrome *b* gene and comparison of this fragment with reference sequences from pumas and other carnivores present in the region. We used a panel containing four microsatellite *loci* to individualize each of the samples collected. Among the 20 fecal samples, we identified 10 as clearly belonging to pumas

and two as belonging to ocelots (*Leopardus pardalis*), a species sympatric with *P. concolor*. By plotting the feces sampling points against a satellite image, we determined the presence of at least nine puma individuals in the region, three in the Jataí Ecological Station, four in the Vassununga State Park, and two in their surroundings. The identity probability was 0.0001 and the occurrence of allelic dropout was 10.6 percent. The presence of pumas, the estimate of their minimum population size, as well as their distribution, constitute an important tool for the implementation of management and conservation programs in the areas studied and their surroundings.

Molini, W, D. Ashman, and J. Jeffress. 1976. Mountain Lion Condition Report and Management Conclusion Summary. Nevada Dept. Wildlife. 9pp.

The total reported statewide harvest to date (4-1-76) is 66 mountain lions compared to 92 at the same time in 1975 which represented a 28% decrease. Depredation take increased by 40% from 10 lions last year to 14 (not complete) this year. White Pine and Elko counties were the major harvest areas accounting for 34.8% and 27.3% of the total harvest respectively. The 1975-76 harvest was composed of 64% females and 36% males. The age structure of the female harvest was 68.3% adult, 7.3% two-year-olds, and 24.4% kittens and yearlings. It was difficult to make an accurate determination of population status on a statewide basis. It was evident that in some of the more popular harvest areas that population size has been reduced through harvest and that population recovery is being restricted by present harvest rates. A quota system is proposed at this time in order to achieve a more even distribution of harvest and to allow recovery of currently depressed populations.

Mondini, M. and , A.S. Muñoz. 2008. Pumas as Taphonomic Agents: A Comparative Analysis of Actualistic Studies in the Neotropics. Quaternary International 180(1):52-62.

Abstract

Puma (*Puma concolor*) taphonomic action on vertebrate assemblages in the Neotropics is described and analyzed. Actualistic information based on the literature and observations are presented from a comparative perspective, to determine some general patterns and, particularly, the ranges of variation in this felid's action. Information available for the Nearctic region is considered for comparative purposes. Particular attention is given to cases departing from the more general trends, such as one case in Mendoza (Argentina) in which the intensity of bone damage is outstanding. Variation in puma taphonomic action in the Neotropics is increasingly apparent as new studies are carried out, and knowledge on the range of this variation and the conditions under which it occurs needs to be deepened by future research.

Monroy-Vilchis, O., Y. Gómez, M. Janczur and V. Urios. 2009. Food Niche of *Puma concolor* in Central Mexico. Wildlife Biology (15)1:97-105.

Abstract

Optimal foraging theory predicts that predators choose the most energetically profitable prey. At the northern limit of its distribution the puma *Puma concolor* tends to prey on large mammals, whereas at the southern limit its prey comprises medium-sized and small mammals. We analysed the puma's food habits in Central Mexico, and concluded that the nine-banded armadillo *Dasypus novemcinctus* is the main prey, followed by the white-nosed coati *Nasua narica* and white-tailed deer *Odocoileus virginianus*. The puma's standardised niche breadth (B') was 0.21 and was in accordance with the expected in the exponential model. We compared this with niche breadths recorded in other studies carried out in the Americas. After a forest fire, puma changed their feeding habits and began to hunt prey > 6.1 kg more frequently. Food preferences of puma in Central Mexico resemble those recorded for puma in South America rather than the preferences recorded for puma in other North American populations.

Montalvo, C.I., M. E.M. Pessino and V.H. González. 2007. Taphonomic Analysis of Remains of Mammals Eaten by Pumas (*Puma concolor* Carnivora, Felidae) in Central Argentina. Journal of Archaeological Science 34(12):2151-2160.

Abstract

Prey remains recovered from puma (*Puma concolor*) scat were analyzed in order to identify taphonomic features produced on them by this predator. Mammal remains are abundant in puma scat, but recognition of bone remains decreases as prey size increases. Modifications produced by digestion are strong. However, micromammal bones show a gradation in preservation that includes well preserved specimens. Data presented here and their interpretation may possibly be extrapolated to zooarchaeological or paleontological assemblage.

Moore, H.D.M., R.C. Bonney, and D.M. Jones. 1981. Successful Induced Ovulation and Artificial Insemination in the Puma (Felis concolor). Vet. Record 108:282-283.

On June 6, 1980, the first large wild cat to be produced by artificially induced ovulation and artificial insemination was born in the Institute of Zoology at London Zoo. Prior to this study, artificial insemination had only been successfully carried out in the domestic cat in the family Felidae. The puma was chosen as a model to study the reproduction of non-domestic Felidae because of its good breeding record and size. Three mature female pumas (two of proven fertility) and one male were used in the study. Procedures, techniques, drug choices and dosages utilized are described in detail. This was the first report of successful artificial insemination in non-domestic Felidae.

Moore, H.D.M., R.C. Bonney and D.M. Jones. 1981. Induction of Oestrus and Successful Artificial Insemination in the Cougar, Felis concolor. Annua. Proc. AAZV.

Techniques involved in the induction of ovulation and artificial insemination of the cougar are presented. To date, four double inseminations resulting in one conception and a single live birth 95 days after HCG injection were reported. This was the first report of successful artificial insemination in a nondomestic felid.

Moreno, R.S., R.W. Kays and R. Samudio Jr. 2006. Competitive Release in Diets of Ocelot (Leopardus pardalis) and Puma (Puma concolor) after Jaguar (Panthera onca) Decline. J. Mammal. 87:808-816.

Abstract

We used fecal analyses to document the diet of ocelots (Leopardus pardalis) and puma (Puma concolor) at 2 sites in central Panama. We detected puma on Barro Colorado Island (BCI) nearly every month during the study but never found evidence of jaguars (Panthera onca) at either site. Both ocelots and puma fed predominantly on mammalian prey, but consumed a diversity of species. Collared peccaries (Pecari tajacu) and Central American red brocket (Mazama temama) were the most important food items for puma, whereas Central American agoutis (Dasyprocta punctata) and sloths (Choloepus hoffmanni and Bradypus variegatus) were the most important for ocelots. Considerable overlap in diet was found between populations and species, but the diet of puma on BCI was significantly different from the 2 ocelot populations in containing more large prey, suggesting that dietary differences between these predator species are chiefly related to their relative body size. Comparing across larger scales, both populations of ocelots in our study ate larger prey than elsewhere in their range, suggesting that their fundamental niche includes more medium-sized prey than their realized niche in other sites. Puma on BCI ate proportionately more peccaries and deer than in most other populations. These unusual diets in the wake of a recent decline or local extinction of jaguars are consistent with a prey shift in response to competitive release.

Morgan, C., J. Harmon and D.A. Martorello. 2008. Studying Public Perceptions and Knowledge of Cougars in Washington as a Precursor to Outreach and Education Planning. Page 188 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

Cougar managers are frequently subject to political pressures that are influenced by public perceptions. Consequently, managing cougars increasingly demands a focus on human dimensions. To that end, Washington Department of Fish and Wildlife (WDFW) and Insight Wildlife Management conducted a public opinion survey in Washington in 2008. The objective of the survey was to better understand the public's perceptions of cougar management, identify information gaps, and define effective outreach methodologies. The survey instrument included questions about the ecological role of

cougars, cougar behavior, human-cougar conflict, availability of educational materials, and preferred themes for education programs. Using a random sampling telephone survey method, we obtained results from over 800 individuals, and conducted a stratified sub-sample in areas with a higher than average frequency of human-cougar conflicts. We present the results of the survey and compare data from similar surveys in other states. Ultimately, the survey will be used to develop a cougar outreach and education plan for WDFW. We present preliminary ideas for this education plan based upon results from the public opinion survey and other successful carnivore outreach projects.

Morris, J.G., J. Fujimoto, and S.C. Berry. 1974. The Comparative Digestibility of a Zoo Diet Fed To 13 Species of Felid and a Badger. Int. Zoo Ybk. 14:169-171.

The apparent digestibility of a commercial zoo diet (Zu/Preem) was compared after being fed to 13 felid and one badger species at the Sacramento Zoo. The apparent digestibility of dry matter, organic matter, and nitrogen was determined by the ratio of the percentage of Chromic oxide and nutrients in the feed and faeces. The results indicated that the digestive efficiencies of these species were similar. The digestive coefficients for the puma was listed as 80.1 dry matter; 83.2 organic matter; and 92.1 nitrogen.

Morrison, B. 1984. New Mexico-Cougar Status Report. Pgs. 49-52 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 cougar was classified as a protected species in 1971. After 1982 it was hypothesized that cougars were declining in the state by 10% annually due to sport hunting. The length of the hunting season was reduced from 11 months to 3 months and the bag limit was changed from 2 cougars to one cougar. Harvest data was provided for 5 seasons from 1979 to 1984. A total of 2,334 licenses were sold and 501 cougars were taken which represented a 21.5% average success ratio for the 5 seasons.

Morrison, S.A. and W.M. Boyce. 2009. Conserving Connectivity: Some Lessons from Mountain Lions in Southern California. Conservation Biology 23(2):275-285.

Abstract

Habitat corridors can be essential for persistence of wildlife populations in fragmented landscapes. Although much research has focused on identifying species and places critical for conservation action, the conservation literature contains surprisingly few examples of corridors that actually have been protected and so provides little guidance for moving from planning through implementation. We examined a case study from southern California that combines monitoring of radio-collared mountain lions (*Puma concolor*) with an assessment of land-protection efforts to illustrate lessons learned while attempting to maintain ecological connectivity in a rapidly urbanizing landscape. As in many places, conservation scientists have provided science-based maps of where conservation efforts should focus. But implementing corridors is a business decision based not solely on ecological information but also on cost, opportunity cost, investment risk, and other feasibility considerations. Here, the type and pattern of development is such that key connections will be lost unless they are explicitly protected. Keeping pace with conversion, however, has been difficult, especially because conservation efforts have been limited to traditional parcel-by-parcel land-protection techniques. The challenges of and trade-offs in implementation make it clear that in southern California, connectivity cannot be bought one parcel at a time. Effective land-use plans and policies that incorporate conservation principles, such as California's Natural Communities Conservation Planning program, are needed to support the retention of landscape permeability. Lessons from this study have broad application, especially as a precautionary tale for places where such extensive and intensive development has not yet occurred. Given how limiting resources are for biodiversity conservation, conservationists must be disciplined about where and how they attempt corridor protection: in rapidly fragmenting landscapes, the opportunity for success can be surprisingly fleeting.

Murie, O.J. 1917. The Cougar at Bay. Outing 60(5):605-609.

The author describes the hunting of a cougar with a friend and his two dogs. The dogs treed a large cougar which was photographed, shot and killed and boiled portions of the cat were fed to the dogs. The meat looked so tender and clean

that they also fried some of the "back strap" and had a good supper.

Murphy, K.M. 1981. Characteristics of a Hunted Population of Mountain Lions in Western Montana. Proj. No. W-120-R-12 (58951), Program 1, Study BG-10.0, Job 1. 6pp. Progress Report.

The student investigator checked approximately 1,350 miles of roads and trails and located over 36 sets of lion tracks in the study area. A minimum of 10 adult females, 4 adult males, and 13 kittens were identified. Fourteen different lions were treed on 19 occasions, and 3 males and 5 females were instrumented with radio-transmitting collars. More than 180 radio-relocations were obtained from tracking collared individuals. At least 23 lion tag holders hunted a minimum of 37 days in the study area and killed 3 lions.

Murphy, K.M. 1981. Characteristics of a Hunted Population of Mountain Lions in Western Montana. Proj. No. W-120-R-13 (5914), Program 1, Study BG-10.0, Job 1. 5pp. Progress Report.

During 39 days, 1,372 km of roads and trails were checked for lion sign; 27 fresh track sets were located (2.0 sets/100 km traveled). Lions were treed on 3 occasions: 1 adult female was recaptured, 1 young adult female was instrumented, and 1 large male died during capture. Before harvest, the known study area population consisted of 3 kittens, 2 juveniles, 2 young adults, and 5 adults. Nineteen hunters spent 32 days hunting lions in the study area, engaged in 7 chases, treed 6 lions, and killed 4. The adjusted adult hunter-induced mortality was 55 percent of the known winter resident population, excluding kittens. Harvest reduced the winter density from 1 resident adult/20.8 km^2 to 1/44.5 km^2. An additional 163 radio-relocations were obtained and coded for computer analysis. Seventy-eight winter relocation sites were visited on the ground in spring and data concerning 9 habitat variables were collected. Three additional kill sites were located during winter, and appropriate data were collected.

Murphy, K. and B. O'Gara. 1982. Montana's Mysterious Cat. Montana Outdoors 13:15-19.

Lions do not require wilderness country and often live close to human developments, especially those in or near big game winter ranges. Adult females weigh 70 to 120 pounds and adult males weigh 150 to 190 pounds. Lions have jumped from trees to the ground from as high as 30 or 40 feet without injury. Large prey in Montana were killed by a powerful bite into the top of the neck just behind the skull which disjoints the vertebrae of the upper neck and causes sudden death. Lions are occasionally injured by their prey but are probably the most efficient killers of all the world's great cats. Montana livestock owners have few problems with lions. Bounties of up to $50 per hide were paid in Montana until 1962 and in 1971 the lion became a legal game and trophy animal. The lion hunting season runs from December 1 to April 30 of the following year but cats can only be killed until February 15 and thereafter lions may only be pursued in a "chase" season and not killed. Between 50 and 100 lions are killed each year in Montana, mostly west of the Continental Divide. Studies in Montana revealed that in a more hunted lion population, home ranges appear larger and more isolated and no territorial markings were encountered. The removal of adults from their home ranges seemed to disrupt the normal social system. Young males in the most heavily hunted drainages were quickly killed, often before they became adults. Many hunters avoided killing females. Available information suggested that populations were stable or increasing in central and western Montana and expanding their distribution eastward.

Murphy, K.M. 1983. Characteristics of a Hunted Population of Mountain Lions in Western Montana (Relationships Between a Mountain Lion Population and Hunting Pressure in Western Montana). Job Final Rep., M.S. Thesis, Proj. No. Montana W-120-R-13 & 14, Job 1, Study No. BG-10.0, Program I, 55pp.

Relationships between hunting pressure and a mountain lion (Felis concolor) population were studied during winters 1979 through 1982. Work was conducted in the Fish Creek drainage, western Montana, which contained easy road access and average winter densities of 7.1 lions/100 square kilometers. The spatial distribution of 8 radio instrumented lions was established with 350 relocations. The amount, timing, and distribution of travel by hounds-men were determined by field observations and interviews. Snow conditions largely determined magnitude and timing of harvest, and road access influenced its distribution. Hounds-men were 87% successful in treeing lions when they released dogs on tracks. Seven lions were killed by hounds-men during ideal snow conditions in the northern portion of the drainage, which contained the primary entrance. Hounds-men usually traveled only by automobile, checked main roads, and concentrated their activities in the northern portion. This population resembled those that were hunted less, except no known transient lions moved

through the area. Concentrated harvest did not deplete the number of adult lions present, although adult densities were slightly lower in the northern than the southern portion. Stability in the numbers of adults and sex ratios was maintained by young adults moving into the area or by local juveniles establishing residence. Lions are easily treed by hounds when winter storms provide a continuous cover of fresh snow. When lion habitat is easily accessible by roads, kills of more than 50% of the resident adults is possible if ideal snow conditions prevail during much of the lion hunting season. However, frequent over-kill in drainages similar to Fish Creek at present is unlikely because periods of favorable snow conditions are usually brief, hounds-men do not thoroughly penetrate lion habitat, and agonistic behavior among hounds-men appears to limit simultaneous use by more than one party of hunters.

Murphy, K.M. 1984. Montana Cougar Status Report. Pgs. 39-43 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 bounty was discontinued in 1962 and Game and Trophy animal status was granted in 1971. This required all hunters to present lion skulls and hides to the Department within 10 days after the date of the kill. Lions are distributed throughout western Montana and portions of central Montana with an isolated population occurring in extreme southeastern Montana. Lion harvests from 1979 to 1984 averaged 102 lions (range 75 to 140). One lion of either sex may be taken each year except lactating females, or any member of the family group containing spotted young. Lions may not be taken with traps or snares.

Murphy, K.M. 1984. Montana-Cougar Research Report. Pgs. 172-173 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.

Relationships between hunting pressure and a mountain lion population were investigated from winters 1979-80 through 1981-82 in the Fish Creek drainage of western Montana. Fish Creek drainage was easily accessible to lion hunters by roads and contained a high winter density of lions (7.1 lions/100km^2). Overlap between home ranges of females was greater than among males and the home ranges of males extensively overlapped those of females. Annual harvests removed 22% and 48% of the female and male lions present. The adult population was not depleted due to quick recruitment from lions both on and off the study area. No nonresident or transient lions were identified.

Murphy, K.M., G.S. Felzien, M.G. Hornocker and T.K. Ruth. 1998: Encounter Competition Between Bears and Cougars: Some Ecological Implications. Ursus 10:55-60.

Abstract

Black bears (*Ursus americanus*) or grizzly bears (*Ursus arctos*) visited 8 of 55 cougar-killed (*Felis concolor*) ungulates in Glacier National Park (GNP), Montana, from 1992 to 1995, and 19 of 58 cougar kills in Yellowstone National Park (YNP), Wyoming, from 1990 to 1995. Bears displaced cougars from 4 of 8 carcasses they visited in GNP and 7 of 19 in YNP. Cougar predation provided an average of 1.9 kg/day (range = 0-6.8 kg/day) of biomass to bears that fed on cougar-killed ungulates. This biomass was an important percent (up to 113%) of the daily energy needs of bears when compared to their caloric requirements reported in the literature. We suggest that ungulate carrion resulting from cougar predation is important nutritionally to bears in some regions and seasons. Cougars that were displaced from their kills by bears lost an average of 0.64 kg/day of ungulate biomass, or 17-26% of their daily energy requirements. Biologists modelling or measuring cougar predation rates should be aware that losses to scavengers may be significant.

Musgrave, M.E. 1926. Some Habits of Mountain Lions in Arizona. J. Mammal. 7:282-285.

Since 1918, more than 600 mountain lions had been killed in Arizona. Kittens were found in every month of the year and stay with their mother until run off by the male who wishes to mate with her. The author had seen a lion spring from the earth and land 12 or 15 feet above in a tree as well as one jump from a branch to the earth fifty or sixty feet below and light on its feet apparently unharmed. The author knew of an old tom to cover more than 20 miles in a single night. The runway of a male lion makes scratches under practically every large tree along the route, although the habit of scratching up piles of leaves is not restricted to the males, for the female also do this. The lion usually stalks its prey until within a few feet and then bounds upon its back, gripping the shoulders with its front claws and often fastening the hind claws in the flanks. Prey

is killed by a bite to the back of the neck and it is usually hauled under a bush or tree before being consumed. Sometimes the prey is carried off by first turning the animal on its back and picking it up by the brisket, all four feet sticking up in the air, and walks off with its head held high. The carcass is covered by leaves, sticks, and rocks. The author had yet to see a lion which measured more than 9 feet from the tip of the tail to the tip of the nose. The largest one taken in Arizona measured 8 feet 7-1/2 inches. The average adult male measures 7 feet 8 inches, and an average adult female 7 feet. The heaviest lion taken in Arizona weighed 276 pounds. The average weight of an adult male would be about 176 pounds and that of a female would be about 125 pounds.

Myers, D. 1960. Mountain Lion at Leader. Blue Jay 18:183.

A mountain lion was seen on September 19, 1960 on the N.E. 1/4 29-23-25 W3 about nine miles northeast of Leader.