

## **Nevada Mountain Lion Status Report**

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### **Cougar Management Plan**

The Nevada Cougar Management Plan aims to maintain cougar distribution in reasonable densities throughout Nevada. Objectives and goals include, for example, the removal of cougars that potentially represent a public safety hazard or are causing property damage, and the conservation of cougars to provide recreational, educational and scientific opportunities. Additional goals include maintaining a balance between cougars and their prey, and finally to manage cougars as a meta-population (Stiver 1995).

### **Distribution and Abundance**

Nevada is a mosaic of landscapes. Cougars seem well-adapted to the wide variety of habitat and environmental conditions. They are known to exist or wander through almost every mountain range from the Mojave Desert in extreme southern Nevada to alpine forests at the highest elevations in the northern part of the state. Distribution appears to be primarily influenced by prey availability. Distribution has remained fairly consistent through time as cougars are known to inhabit every Game Management Unit and every major mountain range in the state. Local densities, however, have been variable over time.

### **History of Nevada's Cougar Prey Base**

Bighorn Sheep (*Ovis canadensis*) were likely the most common of the large ungulate species within the state, inhabiting nearly every mountain range of Nevada (Cowan 1940, Hall 1946, Beuchner 1960, McQuivey 1978). Archeological investigations based on osteological records and petroglyphs have shown bighorns to be one of the more numerous and most widely distributed large ungulates throughout prehistoric Nevada (Harrington 1933, Jennings 1957, Gruhn 1976). After settlement, bighorn sheep populations dwindled under heavy hunting pressure and competition with non-native ungulates (NDOW 2001).

Mule deer (*Odocoileus hemionus*) were more limited in range and density within the state. A review of archeological records indicates that in nearly every site, deer remains were conspicuously absent or rare (Harrington 1933, Schroeder 1952, Jennings 1957, Shutler and Shutler 1963, Gruhn 1976). Only two site investigations in Nevada found mule deer to be a significant contributor to archeological middens (Fowler et al. 1973). Both of these locations occur in the northeastern corner of the state. Aldous (1945) noted that prior to 1925, mule deer were not noticeably abundant anywhere in the Intermountain states.

Mule deer and bighorn sheep hunting were closed by the 1901 state legislature due to subsistence overhunting by miners and other settlers (Hess 1998). Deer hunting was closed for two years while bighorn hunting remained closed for 51 years.

Historical records indicate that prey levels were inadequate to harbor large cougar populations in Nevada (Hall 1946). In 1915, a federal predator control program was initiated in the state. From 1917-1931, only 46 cougars were reported taken by the federal program (Woolstenhulme 2003, USDA reports 1915 -1949). During the years 1950 through 1959, this program accounted for the removal of 988 cougars, an average 99 per year. During the 34-year period (1915-1949), 115 cougars were removed. Simultaneously, USDA trappers reportedly removed 195,320 other predatory animals (Woolstenhulme 2003, USDA Reports 1915 -1949). Given the intensity of predator control for livestock protection, it is reasonable to infer that if cougars had been common a greater number would have been taken or reported.

Domestic sheep became a part of the prey base during the latter part of the 1800s and early 1900s. Huge numbers of these alternative prey species were being introduced into Nevada providing another viable food source for cougars. Nevada tax assessment rolls indicate the number of domestic sheep in Nevada rose from 33,000 in 1870 to 259,000 in 1880 (Elliot 1973). During the first thirty years of the 20<sup>th</sup> century domestic sheep numbers continued to increase, records indicating that the number of sheep in the state reached between 2 and 4.5 million head (Georgetta 1972, Lane 1974, Meaker 1981, Rowley 1985).

Leopold et al. (1945) and Aldous (1945) documented mule deer irruptions occurring in several locations in Nevada during the 1940's, and hypothesized that these "irruptions" were a result of "buck-only" laws, predator control and habitat changes from logging and grazing. Mule deer numbers in Nevada continued to increase, peaking during the mid to late 1950s (Wasley 2004).

For mule deer, a period of decline occurred in the late 1950's. During this decline, numbers never approached historic lows. By the late 1970s, deer populations began to increase again state-wide with a tremendous spike occurring throughout the 1980s (Wasley 2004). By the time state-wide deer populations peaked in the late 1980s, their number had soared in excess of 200,000 (Wasley 2004).

As prey species began to increase, so did cougar numbers and populations were described as an uncommon denizen (Hall 1946, Cahalane 1964, Stiver 1988) had grown in numbers to over 1,000 strong by the early 1970s (Stiver 1988, NDOW 1995 unpublished data). When deer numbers peaked a decade and a half later, estimated cougar numbers in Nevada reached 4,000 (NDOW 1995 unpublished data).

Following the unusually high deer densities of the 1980s, various factors including drought, habitat loss, habitat conversion, range fires and winter kill in 1992–1993 caused deer populations to gradually decline throughout the state. Available evidence suggests that cougar numbers have not decreased proportionately to the deer herd decline. This probably reflects the abundance of alternative prey, including domestic livestock and increasing numbers of other large wild prey.

Over the last twenty years, elk (*Cervus elaphus*) numbers in Nevada have risen nearly 700% and now number 9,500 statewide (Nevada unpublished data 2007). Likewise, feral horse numbers have steadily increased since receiving federal protection and now number around 18,000 in Nevada. Bighorn sheep also continue to increase in the Nevada Mountains (NDOW 2007 unpublished data).

### **History of the Cougars Legal Classification**

In 1965, the cougar's legal classification in Nevada was changed by regulation from an unprotected predator to a game animal. The change in classification resulted in the requirement of a valid hunting license to hunt a cougar, along with some restrictions on the method of take (e.g., trapping was disallowed). This provision precluded the taking of cougars at any time other than from sunrise to sunset and it also defined legal weapons as shotgun, rifle, or bow and arrow. The season was further defined as either sex, year-round, no limit nor was a tag required.

In 1968, a tag requirement was instituted. This made possible the recording of sport hunter harvest.

In 1970, a limit of one cougar per person was set and a six-month season was established. It was then required that all harvested cougars be validated by a representative of the Department within five days after the kill. This regulation presented the Departments first real opportunity to collect biological data from individual cougars.

In 1972, the Nevada Department of Wildlife initiated a study of cougars as a part of the Ruby-Butte deer project in eastern Nevada. The objective was to determine the status of cougar populations within this high-density deer area, and to evaluate them in relation to deer populations. Within two years, this objective was changed to:

1. Establish population estimates of cougars by mountain range or management areas statewide,
2. Establish basic habitat requirements, and
3. Establish a harvest management program.

This program involved cougar monitoring from both land and air and was instrumental in expanding the life history information base, as well as providing an approach toward estimating the annual population status of cougars in key mountain ranges. The findings from this study were then used to formulate an approach towards estimating statewide cougar populations. The data have informed cougar management in Nevada since 1983 (Ashman et al. 1983).

In 1976, 26 cougar management areas were defined statewide, and a harvest quota was established for each to control the sport harvest. This Controlled Quota Hunt was the most restrictive season ever established for cougar in Nevada.

In 1979, the 26 cougar management areas were collapsed into six management areas, each with a specific harvest objective. Hunting in each unit was allowed until the predetermined numbers of cougars were harvested.

In 1981, the Harvest Objective hunting season concept was applied statewide. Initially this system required a hunter to obtain a free hunt permit for the opportunity to hunt in one (1) management area.

In 1994, hunters were allowed to obtain a free hunt permit that authorized the hunter to hunt in two (2) management areas until the established harvest objective was reached. Both of these permit systems allowed hunters to change management areas at will as long as the harvest objective had not been reached in the desired management area(s).

In 1995, the hunt permit approach was again modified to eliminate the physical issuance of a permit in favor of establishing a 1-800 telephone number. This system allowed hunters to hunt in any management area where the harvest objective had not been reached. The hunter was required; however, to call the number before hunting to determine which management area(s) were still open to hunting.

In 1997, changes were made to regulations aimed at increasing cougar harvest, while maintaining the integrity of the harvest objective limits system. Those changes included the reduction of tag fees, over-the-counter tag sales, increasing bag limits from one tag per hunter to two tags per hunter, and consolidation of some of the harvest unit groups.

In 1998, Nevada's southern region was modified to provide for a year-round hunting season on cougars. The entire state went to a year-round season in 2001.

In 2003, changes modified harvest unit groups from 24 groups throughout the state to three statewide regions corresponding with the Division's three management regions. The cougar season continues to be year-round but season dates were changed to March 1<sup>st</sup> of each year to the last day of February the following year, corresponding with the Nevada hunting license.

In 2008, cougar tags were made available online, with an added option of only purchasing a tag if you are not successful in drawing another big game tag.

### **Current Status**

Current cougar populations are believed to be stable (NDOW 2007 unpublished data). The ten-year harvest trend is down in most parts of the State; however the two-year average is above the trend line. Each region in the state exhibits unique characteristics for harvest as well as sex and age structures and are quite independent of each other. As a result of hunting conditions, harvest trends can be independent and unrelated to the actual number of cougars available. In just the last decade, harvest has fluctuated from a high of 210 to a low of 105 (NDOW 2007 unpublished data).

In 2007, legislation was introduced (Nevada Assembly Bill 256) to re-classify cougars as a predator. The proposed state legislative bill and the resulting controversy strongly indicate that research on cougars and interactions with their prey is expected in Nevada. While the bill was defeated, it garnered support from some sportsmen, some mule deer advocates, and several state legislators.

In 2002, Nevada Assembly Bill 291 was proposed by sportsmen to direct collection of a mandatory \$3 fee to tag applications to fund predation management, especially for the protection of mule deer and other big game species. The bill passed. Cougars are currently targeted reactively as well as preemptively for the protection and enhancement of mule deer and bighorn sheep.

The Department uses the best information available to identify when and where predation management is applied to reduce cougar predation on other wildlife resources. Follow-up assessments suggests that selective removal, either preemptively or reactively, has benefited bighorn. Results are less clear for the protection of mule deer.

Results of the most current management actions regarding cougar harvest have addressed the recommendations to increase harvest and hunter opportunity. The actions, discussed earlier, have had mixed results. Extending the season to a year-round harvest has had little impact. Hunting conditions during the summer months are generally poor, and few hunters take to the field. Most recently, the Department has increased the convenience of purchasing cougar tags, and this has substantially increased sales. Whether or not this translates into an increased cougar harvest is unclear and will be tracked.

Within the past decade, the largest effect on harvest was the move to Regional quotas instead of Management Area quotas. In the inaugural year, harvest was increased, as predicted and intended, especially in the historic “hotspots” for cougar hunters. Since that initial pulse following the change harvest has again stabilized.

### **Cougar Management**

Cougar populations are estimated utilizing a life table model (retrospective harvest/mortality). The model utilizes known harvest/mortality rates and recruitment rates (Greenly 1988, Stiver 1995) to calculate a retrospective estimate of minimum viable population size needed to sustain known harvest rates over the same time-period. It also incorporates prey availability as a parameter. Although no defined confidence limit is used, the confidence in this model is relatively high, based on the fact that harvest rates have continued over time at a constant rate without signs of extirpation. Based on our current estimation methods, cougar populations within Nevada are between 2,500-3,500 animals.

Cougars are also known to exist on many of the large land holdings which are closed to cougar hunting in Nevada. These include the complex of the Nellis Air Force Base, the Nevada Test Site, and the Desert National Wildlife Range, which exist as one large contiguous land block of over 19,000 km<sup>2</sup>.

Other non-hunted populations exist on the Sheldon National Wildlife Range comprising 2,355 km<sup>2</sup>. The Great Basin National Park also harbors a healthy cougar population. There are numerous other federally held installations throughout Nevada in the form of national parks, monuments and other military reserves that have non-hunted populations of cougars. In all,

more than 10% of Nevada's 286,298 km<sup>2</sup> is closed to cougar hunting. In addition, much of Nevada is so remote and the terrain so inhospitable for hunting that harvest is negligible.

Cougar harvest objectives are calculated for each administrative region on an annual basis using standardized methodology. Harvest objectives are calculated and recommended in order to achieve a specific management action over a short-term period (no more than two years). Management actions may be designed to increase, stabilize and maintain, or decrease cougar populations within each of the three administrative regions in Nevada.

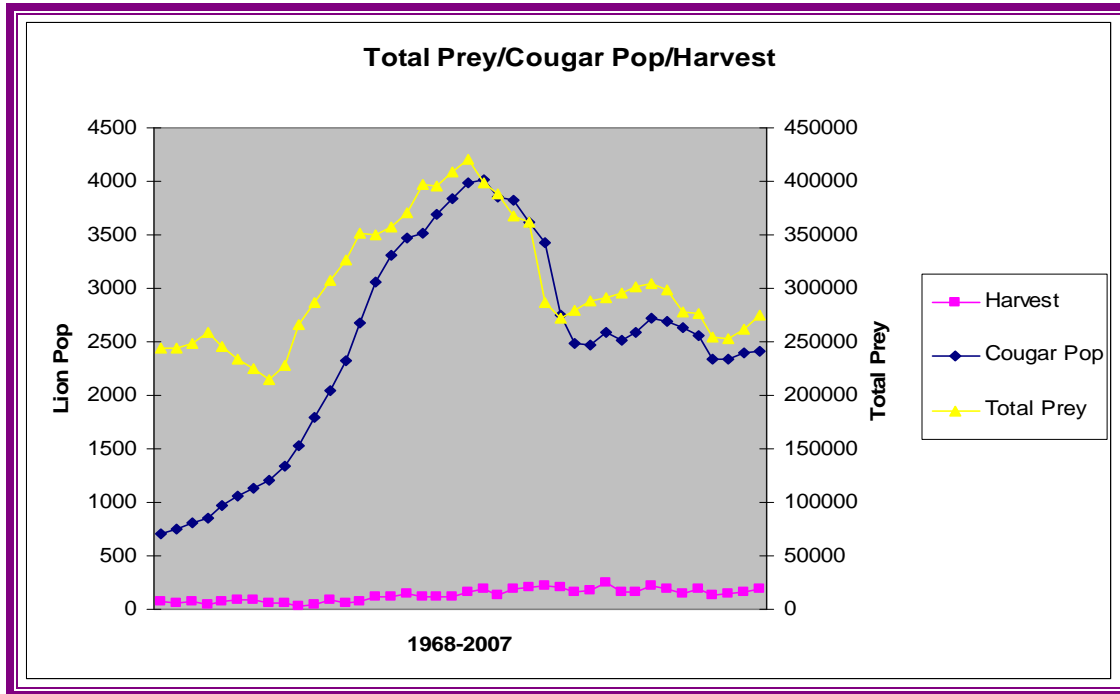
The ten-year harvest average is roughly 42% of statewide harvest objectives and represents only 6% of the current population estimate.

### **Cougar/Prey Relationship**

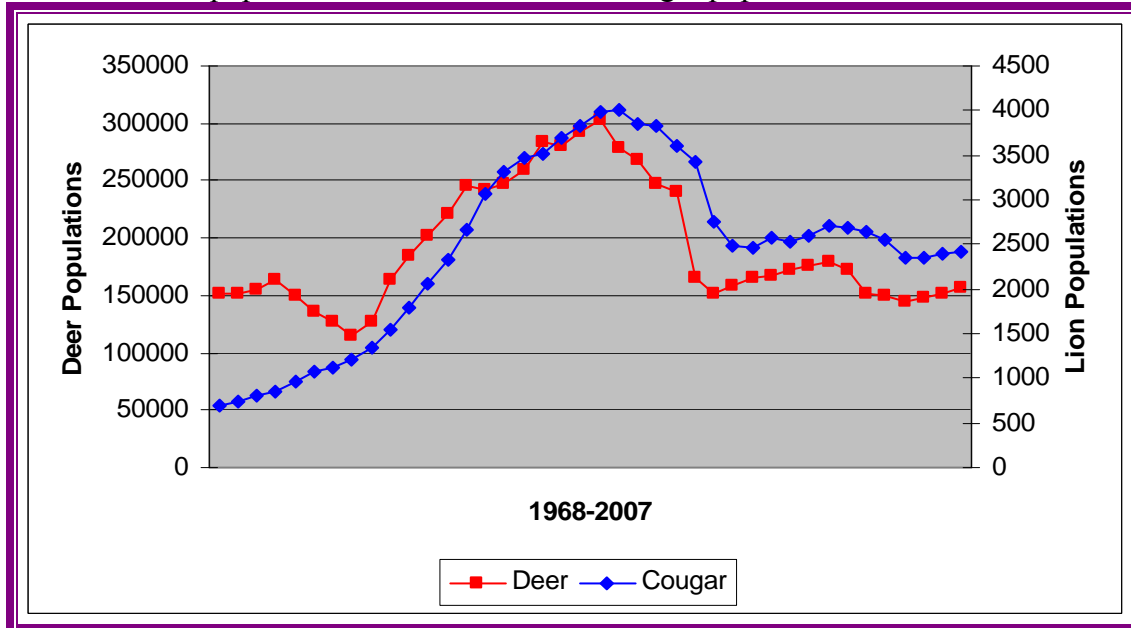
Table 1 represents a linear association with the total prey base that is available for cougar consumption with the associated cougar life table estimating population size. The bottom line represents harvest. The table dates back to 1968 and runs through 2007. The sharp apex coincides with the deer eruption experienced in the mid to latter 1980s and subsequently the decline of the 1990s (Wasley 2004). It is interesting to note that harvest did not spike during that same time nor did it valley subsequently. A small increase in harvest did occur through the 1990s as the deer numbers continued to decline. It is also interesting to note that statewide harvest did not significantly change as the model shows the cougar population aligning itself with the prey base.

Table 2 represents the deer-only aspect as it relates to the cougar model population estimates. The deer trend and the associated cougar estimates follow closely what one would expect until the cross-over. That point begins the increase of several of the alternative prey options. To date all alternative large prey species are still increasing, with deer somewhat stabilizing but at levels far below peak numbers.

**Table 1.** Total prey base as it relates to cougar population model estimates. The bottom line is harvest.



**Table 2.** Deer population trend as it relates to cougar population model estimates.



## **Future Research**

The Department is considering a graduate project to better quantify cougar distribution, abundance, and interactions with ungulate populations in Nevada. The departmental approach to this potential research is an “open-ended” study so that future studies in other parts of the State can contiguously tie into the ongoing effort.

The primary objectives of the study will revolve around four areas of consideration. Those are:

1. Examine the genetic structure of cougars within Nevada and across state lines to identify distinct sub-populations and determine whether they interact as a “meta-population”.
2. Examine prey species selection and kill rates of radio-tagged cougars in select sub-populations.
3. Refine and validate the NDOW cougar population model through extensive ground truthing of model parameters and “spot checking” to test model accuracy.
4. Determine the relative influence of immigration (including source/sink dynamics), prey densities, habitat, roads, hunting pressure, human population growth and other potentially relevant factors in regulating cougar distribution and abundance in different areas of Nevada.

The Nevada Department of Wildlife has been collecting DNA samples from harvested cougars for approximately four years and has over 500 samples. In 2002, the Department began the use of Matson laboratories to acquire more accurate lion age analysis. These age analyses are compared to age estimates provided by field personnel. Ironically, age in both sexes is generally overestimated with males being over aged at a higher rate than females, but the overall averages reveal the field personnel estimates are reasonably accurate (Lansford unpublished data). The teeth are extracted by the Department at the check-in on a volunteer basis but the practice is well supported by the sportsmen. In the past a letter authenticating the age the sportsmen’s harvested cougar was sent to them in appreciation for the sample. The practice is being resurrected.

## **Conclusion**

As with all big game species in Nevada, cougar populations are carefully monitored for responses to harvest. The available data suggest the following:

1. Cougars in Nevada, while lower than peak numbers in the 1980’s, overall are well above historic levels.
2. Although deer populations and livestock numbers are declining range-wide across Nevada, other alternative prey species are increasing. It is important to understand how effective and efficient cougar populations are at prey switching.
3. The sex, age structure and harvest trends for different areas of the State are somewhat unique and dynamic and require management to reflect that in an adaptive strategy.
4. Research is needed to identify cougar dispersal patterns, corridors and relatedness through genetic structure.



5. The Department recognizes and supports research and integrates all available information into management plans; especially those which relate to identifying trends in population structure and landscape level changes that require timely and active management.
6. The Department will continue to closely evaluate projects where cougars are removed for ungulate enhancement.
7. The Department will continue to seek a balance in addressing sporting opportunity, prey impacts, public opinion with viable cougar populations.

## Literature Cited

- Aldous, C.M. 1945. A winter study of mule deer in Nevada. *Journal of Wildlife Management* 9:145-151.
- Ashman D.L., G.C. Christensen, M.L. Hess, G.K. Tsukamoto, and M.S. Wickersham. 1983. The cougar in Nevada (Federal Aid in Wildlife Restoration Final Report W-48-15, Study S&I 1, Job 5 and Study R-V, Job 1). Nevada Department of Wildlife, Reno, USA.
- Beuchner, H.K. 1960. The bighorn sheep in the U.S.. Its past, present, and future. *Wildlife Monographs* No. 4, 174pp.
- Cahalane, V.H. 1964. A preliminary study of distribution and numbers of cougar, grizzly and wolf in North America. *New York Zoological Society*, 12pp.
- Cowan, I.M. 1940. Distribution and variation of the native sheep of North America. *American Midland Naturalist* 24:505-580.
- Elliot. R.R. 1973. *History of Nevada*. University of Nebraska Press, Lincoln, USA.
- Fowler, D.D., D.B. Madsen, and E.M. Hattori. 1973. Pre-history of southeastern Nevada. *Desert Research Institute Published In the Social Sciences* No. 6. 145pp.
- Georgetta, C. 1972. *Golden Fleece in Nevada*. Venture Publication Co. Reno, NV. 562pp.
- Greenly, J.C. 1971. The status of cougar in Nevada. *In* Jorgensen S.E. and L.D. *Mech eds. Proceedings of a symposium on the native cats of North America; their status and management*. U.S. Bureau of Sport Fisheries and Wildlife. Twin Cities, Minnesota. 139pp.
- Gruhn, R. 1976. Excavation in Amy's Shelter, Eastern Nevada. *Nevada State Museum Anthropological Papers*, No. 17, Carson City, USA.
- Hall, E.R. 1946. *Mammals of Nevada*. University of Nevada Press, Reno, USA
- Harrington, M.R. 1933. Gypsum cave, Nevada. *Southwest Museum Papers*, No. 8. Los Angeles, CA, USA.
- Hess, M. 1998. Nevada, the Kaibab, deer and predators. Special report prepared for the Nevada Wildlife Coalition. Nevada Division of Wildlife. Reno, USA.
- Jennings, J.D. 1957. Danger Cave. *University of Utah Anthropological Papers* No. 27:XIV 328pp.
- Lane, R.H. 1974. The cultural ecology of sheep nomadism: northeastern Nevada, 1870-1972. Ph.D. Dissertation. Yale University. New Haven, CT. 374pp.
- Leopold, A., L.K. Sows, and D.L. Spencer. 1947. A survey of over-populated deer ranges in the United States. *Journal of Wildlife Management* Vol. 11: 162-177.
- Meaker, R. 1981. *Nevada desert sheepman*. Western Print and Publication Co. 147pp.
- McQuivey, R.P. 1978. The Bighorn Sheep of Nevada. *Biological Bulletin* No. 6. Nevada Department of Wildlife. Reno, USA. 81pp.
- Nappe, L. 1974. On the track of the cat. *Wildlife and Natural Areas, Forestry Institute* 2:13-16.

- Nevada Department of Wildlife (NDOW). 2001. Bighorn Sheep Management Plan, Game Division. Reno, USA. 36pp.
- Nevada Department of Wildlife, (NDOW). 2007. Big Game Status Report. Internal document, Game Division. Reno, USA 89512. 161pp.
- Nowak, R.M. 1974. The gray wolf in North America; a preliminary report. Report to New York Zoological Society And U.S. Bureau of Sport Fisheries and Wildlife, USFWS 254pp.
- Rowley, P.H. 1985. U.S. Forest Service grazing and rangelands, a history. Texas A&M Univ. Press. College Station, 270pp. USA.
- Schroeder, A.H. 1952. The significance of Willow Beach Plateau. University of Utah Anthropological Papers Vol. 25, No. 2. pp 27-29.
- Special Committee on Conservation of Wild Life Resources, United States Senate. 1934. Grazing of sheep on the public domain and in the national forests. Hearings before the Seventy-Third Congress, Second Session. United States Government Printing Office. Washington D.C.
- Stiver, S.J. 1988. Status of cougars in Nevada. Proceedings of the Third Cougar Workshop. Prescott, AZ. Arizona Game and Fish Department. 26-29.
- Stiver, S.J. 1995. Comprehensive Cougar Management Plan. Internal Publication, Nevada Department of Wildlife, Reno, USA.
- Shutler, M.E., and R. Shutler, Jr. 1963. Deer Creek Cave, Elko County, Nevada. Nevada State Museum Anthropological Papers, No. 11, Carson City Nevada. 70pp. USA.
- USDA. 1915-1949. Annual Report, Predatory Animal Control, Nevada District (series).United States Department of Agriculture, Bureau of Biological Diversity and Nevada State Rabies Commission Cooperation. Carson City, USA.
- Wasley, T. 2004. Nevada's mule deer population dynamics: issues and influences. Nevada Department of Wildlife. Biological Bulletin no. 14. Reno, 70pp. USA.
- Woolstenhulme, R. 2003. Nevada Cougar Status Report. Proceedings of the Seventh Cougar Workshop. Jackson, WY. USA.