The Southwest Biodiversity Initiative

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Open letter to the New Mexico Game Commissioners and the New Mexico Department of Game and Fish on the department's plan to reduce cougar populations in four New Mexico mountain ranges, in an effort to relieve cougar predation pressure on bighorn sheep

Cougar/bighorn interactions and sustainable ecosystem management in New Mexico

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Abstract

The New Mexico Department of Game and Fish has proposed a plan to remove a total of 34 cougars each year for five years from four mountain ranges in New Mexico in an effort to relieve cougar predation pressure on dwindling bighorn sheep herds. We agree that bighorn sheep recovery is a worthwhile goal, and that some cougar removal may further that goal. However, other longer-term threats to bighorn sheep herds should be carefully considered. Habitat and metapopulation fragmentation and habitat loss due to human activities are likely to be important factors in sheep population declines, and any management plan for bighorn should carefully study and address these issues. Additionally, we submit that selective removal of cougars believed to be preying on bighorn may be a far less disruptive strategy on cougar populations than arbitrary removal of 34 cougars each year. We believe that the current situation presents an excellent opportunity for a scientific study of the effects of cougar predation on bighorn populations, and we briefly outline the design for such a study. The limitations of knowledge in the resource management and scientific communities about cougar populations in New Mexico demands that our management of cougar populations be judicious and conservative.

The Southwest Biodiversity Initiative is a scientific organization dedicated to the protection and restoration of the native biological diversity of the American Southwest and Mexico. SBI's members seek to develop the scientific data and technical expertise that will facilitate conservation of native biological diversity in this region. The organization also endorses scientifically sound proposals that accomplish its goals. SBI's members include faculty, staff and graduate students of the UNM Biology Department as well as conservation professionals in state and federal agencies

Introduction

In July of 1999 the New Mexico Department of Game and Fish announced a plan to kill a maximum of 34 cougars (*Puma concolor*) in New Mexico each year for five years in an effort to reduce cougar predation on dwindling bighorn sheep herds (*Ovis canadensis*). According to this plan, a maximum of seven cougars– also known as mountain lions or puma -- would be killed each year in the Ladron Mountains, seven each year would be killed in the Manzano Mountains, and 20 each year would be killed in the Peloncillo and Hatchet Mountains combined. This will represent a 19.3 percent increase over the 176 cougars planned to be lost to sport hunting during this first winter (1999-2000) of the proposed plan.

This plan was developed as a result of recent, steep declines in the number of bighorn sheep in New Mexico, and is intended to allow bighorn populations the opportunity to recover to more sustainable levels. We agree that sustainable bighorn populations are a worthwhile management goal, and that some reduction in cougar numbers in some locations may indeed relieve predation pressure on bighorn populations. However, we suggest that the current problem facing the bighorn herds includes important other, longer-term issues such as:

- ?? habitat and metapopulation fragmentation and habitat loss due to human economic activity, including road building, timber harvesting, mining, urban and residential development;
- ?? habitat loss due to fire suppression and the resulting loss of grasslands to shrub and woody vegetation;
- ?? habitat loss and competition for forage that results from commercial grazing.

These causes for declines in populations of large wildlife species, including bighorn sheep and their predators, have been well studied all around the American West and the world (Soulé 1986, NMDGF 1995, Dunn 1996, Noss et al. 1996, Reed et al. 1996, Logan et al. 1996, Meffe and Carroll 1997). Careful and serious attention to these issues may yield management solutions that allow for sustainable cougar and bighorn populations for the long term. Without adequately addressing these issues, however, we believe that bighorn populations may continue to decrease to eventual extirpation regardless of how many cougars might be removed from the system now or later. This is especially likely if human demographic and economic trends in the state continue.

Since the issues named above – of paramount importance to long-term sustainability of wildlife populations -- are well understood and documented, we will focus in this letter on other important issues raised by the cougar removal plan being proposed by the NMDGF. Specifically, we will argue that current scientific understanding of predator-prey relationships in general and cougar-bighorn relationships in particular recommend at least two major modifications to the current plan:

1) Selectively remove the few cougars believed to be preying upon bighorn sheep; this could result in a more cost-effective and conservative outcome.

2) if arbitrary cougar removal must occur, then fashion the removal as an experiment following rigorous scientific guidelines. This is not currently part of the plan. In this way, the results might not only benefit bighorn populations in the short term, but they would add to the base of scientific knowledge required by resource managers and

conservation biologists for wildlife population recovery and sustainability in the long term.

In this letter, we will attempt to support this position by addressing the following questions:

1. In general, how often should cougars be expected to prey on bighorn sheep, relative to other prey species?
2. How quickly will the vacancies created in cougar populations by the proposed management plan be filled by other cougars dispersing from surrounding areas -- i.e., will the planned removals really benefit the bighorn populations?
3. How are bighorn populations controlled by cougar predation, if at all?
4. Will the removal of cougars, a top predator in the system, have other unexpected effects in the system?
5. What long-term effect will cougar removal have on New Mexico cougar populations?

We will draw upon existing scientific literature to address these questions. We recognize that both we and the managers in the New Mexico Department of Game and Fish all share a deep wish for the maintenance of rich, diverse and sustainable ecosystems in our state -- ones that will benefit not only wildlife but human populations that surround them. In the pages that follow, we hope to add a positive perspective, based on our best scientific understanding, to the current debate. This letter is written not only for the managers in NMDGF, but also for all readers with an interest in these issues.

In general, how often should cougars be expected to prey on bighorn sheep, relative to other prey species?

The studies cited below support the idea that bighorn sheep are not the preferred prey of cougars, and that cougar predation on sheep is generally rare.

In a 10-year study of cougars in the San Andres Mountains of southern New Mexico commissioned by the NMDGF and completed in 1996, 525 animals killed as prey by cougars were discovered, and of that number only 10 (1.9 percent) were bighorn sheep (Logan et al. 1996). Mule deer comprised 91 percent of the prey animals.

In 41 cougar kills discovered from 1991 to 1993 by Arizona Fish and Game Department researchers in the Aravaipa-Klondyke area of southeastern Arizona (Cunningham et al. 1995), 56 percent were deer, 24 percent were cattle less than 10 months old, 10 percent were javelina and 10 percent were bighorn sheep. The authors' characterized the cougar population as high, and the sheep population in the area as being in good health.

In that study, bighorn remains were the least common found in analysis of 370 scat samples collected in the area, behind the remains of deer, cattle, rabbits, rodents and javelina. The frequency of occurrence of bighorn remains in the scat samples was 0.02 percent, representing 1.7 percent of the prey biomass consumed by the cougars. In numbers, rabbits were the most frequently killed prey item, followed by deer, rodents, javelina, cattle and desert bighorn, in that order (Cunningham et al 1995).

In another study (Hornocker 1970), elk and mule deer made up 70 percent of the cougars' prey, including 53 elk and 46 deer. Snowshoe hares made up 5.5 percent and various other small mammals made up the remainder. Cougars also killed three coyotes, two bighorn sheep and one mountain goat in the study area. Most elk and deer taken by cougars were young or old animals, and about half the elk were considered to be in poor physical condition.

How quickly will vacancies created in cougar populations by the proposed management plan be filled by other cougars dispersing from surrounding areas -- i.e., will the planned removals really benefit the bighorn populations?

The studies cited below suggest that cougars may reproduce and disperse to fill vacancies so quickly that attempts to reduce cougar density in specific locations may be ineffective. However, these studies also point out the variability in cougar population dynamics, and underline the need for more research into the effects of experimental cougar removals.

Cougars are well known for their abilities to travel long distances. Various researchers have found cougars to have dispersed up to or more than 160 km in their search for adequate habitat (Hornocker 1970, Anderson et al. 1992, Logan et al. 1996). Further, cougars are known for their ability to travel quickly. Anderson et al. (1992) report that a female traveled approximately 43 linear km in approximately nine hours, and Beier (1995) reports of a dispersing male that traveled 29 km within 48 hours.

Also, cougars are known to disperse long distances from the areas in which they were born. Ashman et al. (1983) concluded that 80 percent of juvenile males, but only 25 percent of juvenile females, dispersed from their natal areas. They report cougars crossing "inhospitable desert habitat" in order to reach other acceptable, higher elevation habitat, and Logan et al. (1996) corroborate that report. Ross and Jalkotzy (1992) similarly found that all of 24 marked male kittens dispersed from their natal area, but that at least seven females did not. Anderson et al. (1992) show that all of 9 radiocollared male cougars in their Uncompahgre Plateau study area dispersed from their natal areas, but that two of six female cougars did not, and Hornocker (1970) reports similar results.

Both Smallwood and Fitzhugh (1991) and Cunningham et al. (1995) report data that corroborate the idea that cougars quickly disperse into vacancies created in high quality habitat by the death of resident animals. Cunningham et al. (1995) note that cougars reproduce rapidly and that the juveniles can disperse long distances before establishing residency in an area. According to Cunningham et al. (1995), "continued removal [of cougars] had little or no numerical effect" on the cougar population in the area, although they admit that declines in nearby populations that provided immigrants to their study area might have occurred.

Power (1976) reports on a cougar population in Idaho reduced by sport hunting. In the winter of 1971-72 twenty-six cougars (of an approximated population of 30) were killed in a 4,400 km^2 area, followed by the killing of 39 more cougars over the next six years. However, reoccupancy of the area was so rapid that Power could detect no annual changes in densities.

Robinette et al. (1977) report that removal of one-half the cougars from a deer area left the number of cougar depredations in the deer kill unchanged. Also, Evans (1983) wrote, "The current high intensity assault on the southern portion of the cougar population in the Guadalupe Mountains, New Mexico, has removed at least 52 cougars in 36 months while depredations on domestic sheep not only continue, but increase (Evans 1983.)"

In a Utah study, the loss of five cougars due to natural death or removal reduced the cougar population in a 1900 km^2 study area by 42 percent, but after nine months the population had recovered to previous levels (Lindzey et al. 1992). Balancing the studies above, Logan et al. (1996) found that after the removal of 53 percent of adult cougars in a study area (representing 13 cougars in a study area of 703 km^2), the cougar population took 31 months to recover to previous levels.

How are bighorn populations controlled by cougar predation, if at all?

Data suggest that cougar predation does not reduce bighorn populations in most cases; however, where cougar predation does control bighorn population growth, the removal of individual cougars that have developed a preference for bighorns may be an effective management strategy. The studies below underline the need for more research into the effects of cougar predation on small bighorn populations.

Some studies have shown that cougar predation does have the potential to cause declines in already small prey populations. Wehausen (1996) concluded that declines in bighorn sheep populations in two mountain ranges in California were due to cougar predation. Ken Logan, primary author of the ten-year NMDGF cougar study conducted in New Mexico's San Andres Mountains, agrees that cougar predation may limit small bighorn populations, such as those currently in New Mexico (Ken Logan, personal communication). Also, cougar predation has also been implicated in the near-extinction of a population of porcupine in the Great Basin (Sweitzer et al. 1997). These findings support the removal of cougars as a strategy for boosting bighorn population recovery in New Mexico.

However, other studies in regions where bighorn populations were not so low show that cougar predation can have little or no effect on prey population size. Hornocker (1970) showed that cougar predation was ineffective in controlling deer and elk populations in Idaho, and had no significant effect on bighorn populations. Two other studies in New Mexico explicitly addressed the effect of cougar removal on bighorn populations; however, neither was able to show that removing cougars had an effect on bighorn population size (Evans 1983, Logan et al. 1996).

Evans (1983) wrote, "experiences of the [New Mexico] Department [of Game and Fish] in cougar control to protect the desert bighorn sheep indicate that the programs were ineffective in reducing depredations." Logan et al. 1996 reached a similar conclusion: "[given the environmental conditions of their study], controlling cougars in an attempt to increase sheep survival rates and to increase the sheep population would probably be ineffective."

Where cougar depredation is affecting bighorn populations the selective removal of cougars known to have a preference for bighorn sheep may be a promising management tool. Logan et al. (1996) found that after the removal of a single cougar that was known to have killed three sheep in three months, cougar predation on bighorns in their study site declined considerably. Similarly, in a study of cougar predation on bighorn sheep in Alberta, the rate of decline in a sheep population slowed after the death of a single female cougar that had killed nine percent of the sheep population and 26 percent of the lambs over one winter (Ross et al. 1997). It appears that individual cougar behavior may be more influential on bighorn predation than cougar population density.

Will the removal of cougars, a top predator in the ecosystem, have other unexpected effects in the system?

The studies below suggest that the removal of top predators from a system can have effects that cascade throughout the system. Following this rationale, the arbitrary removal of cougars may have unpredictable impacts on regional ecosystems and lead to unforeseen events.

Although the data suggest that cougar predation generally does not contribute to the reduction of ungulate prey populations, there are data supporting the idea that cougar predation can be an important factor controlling potentially damaging population explosions of ungulate species. Hornocker (1970) showed that the effect of cougars on dampening prey population oscillations can be important as a way of preventing overstocking and range damage. Hornocker cites Craighead and Craighead (1956), Pitelka et al. (1955), Klomp (1956), and Holling (1959) for their contributions to that idea.

Hornocker (1970) pointed out that cougar predation maintains the overall health of its prey population over evolutionary time by culling poorly adapted individuals from the population, and cited Allen (1954), Buechner (1960), and Popham (1942), in support of that view. Lastly, he described how deer and elk will tolerate the presence of a cougar or a cougar family in their vicinity, but that as soon as a kill is made the entire herd moves to another location, sometimes leaving the drainage entirely. This ungulate behavior, due to predation, may prevent the despoliation of one section of range by overgrazing (Hornocker 1970).

If the removal of cougars by humans from an area did succeed in lowering cougar densities for significant periods of time in that area, then other important ecological events may transpire. In a famous study, Paine (1966) found that the removal of the top predator from intertidal pools along the Pacific Northwest coast caused a dramatic reorganization of the entire community within the pools.

Soulé et al. (1988) suggested that a decrease in abundance of a top predator can change the species composition of predators in the community and lead to a "meso-predator release," or the increase in populations of smaller predators whose populations were previously controlled by the top predators. They suggested that the increased abundance of smaller predators may have further impacts on community composition. In fact, Crooks and Soulé (1999) found that the presence of coyotes in southern California sage habitat communities maintained bird diversity -- since where coyotes were absent feral cats were more abundant, and feral cats were much more effective at reducing bird populations than coyotes.

What long-term effect will arbitrary cougar removal have on regional cougar populations?

So little is known about cougar populations in New Mexico that it is very difficult to predict the long-term effect of arbitrary cougar removal on regional populations.

Given all the studies cited above, it is clear that there is still far more to be learned about cougar populations in New Mexico. Many factors related to cougar populations in New Mexico remain unknown, including:

?? The total cougar population size in New Mexico;

?? the cougar population sizes in the areas where cougar removal is proposed;

?? the cougar population sizes surrounding the removal areas;

?? the effects of sport hunting on cougar populations across the state (Logan et al. 1996).

Localized cougar removals may indeed depress local populations over a significant time scale, and dispersal of cougars from neighboring populations into the vacated areas may depress those neighboring populations. How the cougar population in New Mexico as a whole will respond to these impacts is unknown.

On yet another scale, the removal at the current annual rate of of approximately 200 adult cougars from the general New Mexico population by sport hunting, livestock depredation control and other management strategies may have other long-term effects on cougar populations. According to Chuck Hayes, the cougar/bear program manager at NMDGF, the cougar population in New Mexico includes between 2000 and 3000 animals (personal communication). For perspective, consider that the removal of 200 cougars a year from a population of 2000 can be compared to the removal of approximately 50,000 people a year from the greater Albuquerque area. Could we predict the effects of human loss at that scale on the economic and social dynamics of a city? We assume that cougar populations recover from these annual removals more quickly than would human populations. However, no one really knows how these removals effect cougar population age structure, genetics, social behavior or the ultimate sustainability of the population, or how the removals effect larger-scale ecosystem processes (Ken Logan, personal communication). In the face of these uncertainties, including the others listed above concerning cougar/bighorn interactions, a conservative management strategy might be appropriate.

Conclusions

Following all the studies cited above, we suggest that an arbitrary reduction in cougar population densities – as suggested in the proposed management action – may not be the most prudent nor the most efficient management strategy employed to support the recovery of bighorn populations. We suggest that the most effective short-term management strategy for this situation is the selective removal of cougars believed to be preying disproportionately on bighorn sheep. A concerted effort made along these lines might relieve predation pressure on bighorn populations while at the same time making the least impact on cougar populations – and the expenses associated with this strategy might be lower than with the proposed plan.

However, another alternative exists as well. The current situation offers a premier opportunity for a scientific experiment that could add important knowledge to the field of cougar/bighorn interactions and management. A study could be designed to assess the different effects of selective cougar removal in some areas, arbitrary cougar removal in other areas, and no cougar removal in other "control" areas.

A simple, yet effective, design for such a study would be to divide each of the proposed "cougar removal zones" into two areas; the proposed cougar removal would occur in one half of the currently proposed area, and no additional lion removal would occur in the other half. NMDGF would monitor the response of cougar, bighorn sheep, and other prey populations in both the "removal" and "control" areas of each of the currently proposed "cougar removal zones". Midway through the experiment the removal and control areas could be rotated, to account for variation in habitat. Monitoring would continue throughout the five year project period and for some period (perhaps five years) beyond the end of the proposed cougar removal project.

A study of this kind could address other questions as well, such as:

?? Do infestations of psoroptic mites (scabies) in bighorn populations increase the susceptibility of bighorns to cougar predation (NMDGF 1995, Logan et al. 1996)? If this is the case, perhaps an attempt to control mites is a more prudent strategy than an attempt to control cougars.

?? Do radio-collars on bighorn sheep increase the susceptibility of bighorns to cougar populations (Rominger and Weisenberger 1999)? If this is the case, then the elimination of radio monitoring for sheep might also help reduce predation pressure.

We believe that unless the planned cougar removal is conducted within the framework of an experimental design, and unless monitoring cougar and prey population response to cougar removal is part of the removal program, there will be no way to determine whether cougar removal was an effective or an efficient use of resources. Conducting lion removal as a carefully planned experiment may be more costly and time consuming than arbitrary cougar removal. However, NMGFD does not have the time or resources to wisely manage the state's cougar resources into the future without data regarding the effectiveness of its cougar management strategies.

Members of the Southwest Biodiversity Initiative offer their assistance in developing a study of the kind described above.

Furthermore, whichever cougar removal plan the NMDGF ultimately uses, we strongly urge additional efforts to minimize impact on cougar populations in the state. As a result of recommendations in the Logan et al. (1996) study, the NMDGF instituted a cougar management plan in New Mexico. This plan divided the state into cougar management zones in which different levels of sport hunting pressure would be placed on cougar populations. In one category of zones, cougars would be hunted at a level believed to reduce cougar populations in the zones. In another category of zones, cougars would be hunted at a level intended to maintain the cougar population in the zones. And in a third category of zones, cougars would not be hunted at all in an effort to provide a refuge for natural evolutionary processes to occur. The cougar hunting season of 1999-2000 represents the first year that the cougar management zone strategy will take effect; if the proposed cougar removal plan is implemented, then this plan will also be abrogated in its first year.

Even though the sizes of cougar populations in the different management zones are unknown, and although the results of hunting on cougar populations are unknown, we believe that the cougar management zone strategy represents an excellent start in an effort to objectively manage cougar populations. Therefore, if the proposed cougar removal plan is implemented in zones where bighorn sheep populations are declining, we strongly urge the NMDGF to relieve sport hunting pressure on cougar populations in other zones where bighorn sheep do not occur, or to create another cougar refuge in some other part of the state, at least for the duration of the cougar removal actions. This may help maintain long-term sustainable cougar populations in the state.

Lastly, we feel it is very important to recognize that cougar/bighorn interactions are extremely complex and that cougar reduction of any kind must be considered a very small part of the effort to support bighorn recovery in New Mexico. As cited above, habitat and metapopulation fragmentation and habitat loss due to human urban, residential and industrial development, road building, logging and mining have all taken their toll on wildlife species in New Mexico and the West, including bighorn. In the absence of fire, trees and shrubs grow in grasslands resulting in the eventual loss of ungulate forage; human fire suppression in New Mexico mountains and canyons, therefore, has further reduced bighorn forage and habitat. Commercial grazing in New Mexico mountains and canyons reduces forage yet again. Studies have suggested that cattle further fragment bighorn habitat, and that newly reintroduced bighorn are very sensitive to the presence of cattle (Bissonette and Steinkamp 1996). Commercial grazing also contributes to overgrazing, erosion, changes in species composition, soil compaction, destruction of riparian habitats and pollution of streams, all of which can directly and indirectly impact bighorn populations. Finally, sport hunting of other ungulate species, such as elk and deer, may reduce populations of primary cougar prey to levels such that cougars are compelled to target bighorn instead. All of these factors must be taken very seriously in developing a long-term management plan for bighorn recovery. Most importantly, managing for all those factors will support general ecosystem function, which will benefit not only bighorn, but all other wild species as well.

We believe that the managers at the New Mexico Department of Game and Fish are well aware of and sensitive to all the complex ecological interactions mentioned above, and we are grateful for the conscientious work done by committed individuals at all levels of the department to protect New Mexico's ecological resources. We offer this letter as a way of lending our support to careful, thoughtful, whole-system resource management based on the best current understanding of ecological principles. We encourage further dialogue on this subject between our organization, state agencies and the concerned public, and we offer our participation in any effort that can contribute to sustainable ecosystem management in the Southwest.

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