M e m o r a n d u m

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From : Tom Stephenson, Program Leader
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Subject: Predator Management Protocol

Effective immediately, please consider the following document as guidance for managing mountain lions that threaten the recovery of Sierra Nevada bighorn sheep.

Attachment

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PREDATOR MANAGEMENT PROTOCOL

SIERRA NEVADA BIGHORN SHEEP RECOVERY PROGRAM

February 2010

Recommendations

Entire Recovery Area for Sierra Nevada Bighorn Sheep

Houndsmen will deploy GPS collars that download via satellites on all mountain lions in proximity to the recovery area. On a monthly basis, all GPS clusters that are potential Sierra bighorn kill sites are to be identified and investigated. Data sheets of cluster investigation are to be completed and entered into the predator database. Capture of unmarked lions is the highest priority, along with ensuring that collared lions are recollared prior to collar failure. When all lions in proximity to bighorn are collared, effort may be expended on determining the reproductive status of female lions. When lions are captured, samples (tissue or blood) for identification of DNA will be collected and archived for analysis. When bighorn kill sites are investigated, lion fecal samples will be collected and archived for DNA analysis.

Southern Recovery Unit

Given recent predation rates and the risk posed by mountain lions in this unit, mountain lions that use the herd units occupied by bighorn sheep will be removed, regardless of whether they remain within a herd unit. If a female with dependent young is removed, every effort will be made to locate the young and young of appropriate ages will be transported to the Wildlife Investigations Lab, Rancho Cordova, CA.

Central Recovery Unit

As long as predation on females remains low, only offending mountain lions will be removed following a single incidence of predation on bighorn sheep. Offending lions will be removed regardless of whether they remain within a herd unit.

Northern Recovery Unit

The Mt. Warren and Mt. Gibbs herds remain small; consequently, we cannot afford to lose bighorn sheep to mountain lions. Currently, the likelihood of predation remains low because mountain lion use in the Northern Recovery Unit has decreased since 2002 and resident mule deer usually migrate to the east during winter and mountain lions typically follow mule deer to more distant winter ranges. Nevertheless, if mountain lions are observed using occupied bighorn winter ranges they will be removed. During summer, mountain lions will be intensively monitored to ensure that threats do not exist on summer ranges as well.

Background and Justification

Sierra Nevada bighorn sheep (Ovis canadensis sierrae) are genetically and morphologically distinct, and represent a unique sub-species (Wehausen 2005; U.S. Fish and Wildlife Service 2008). Sierra bighorn received final listing as a federal endangered species on January 3, 2000 (U.S. Fish and Wildlife Service 2000). Shortly thereafter, the California Department of Fish and Game elected to be the lead agency in the

implementation of recovery, and through specific funding by the California Legislature, initiated a recovery program for the species. The mandate of the program was to recover the species under the guidance of a recovery plan (U.S. Fish and Wildlife Service 2007). "The recovery objective is to attain population sizes and geographic distribution of bighorn sheep in the Sierra Nevada that assure long-term viability of the overall population and thereby allow its delisting as an endangered species (U.S. Fish and Wildlife Service 2007)." One of the primary tools identified by the recovery plan to promote recovery is translocation of bighorn to areas historically inhabited, but currently extirpated. Only animals belonging to this subspecies are to be used for translocations (U.S. Fish and Wildlife Service 2007). The limited source stock available for translocations requires that both source and recipient populations be protected from factors that limit recovery.

At the time of listing, mountain lion predation was identified as one of the primary threats to recovery (U.S. Fish and Wildlife Service 2007). Wehausen (1996) documented that mountain lions were limiting Sierra Nevada bighorn sheep. Suppression of growth rates in bighorn populations by predation from mountain lions has been documented in other regions (Festa-Bianchet, et al. 2006, Rominger and Goldstein 2008). Festa-Bianchet et al. (2006) determined that mountain lions can cause the extinction of isolated populations of bighorn sheep. In the Sierra Nevada, currently all of our recovery units qualify as isolated populations that do not yet function in the context of a metapopulation. Similarly, desert bighorn sheep in New Mexico had state endangered status and existed as disjunct populations. Predator management was used successfully in that state to recover desert bighorn sheep (Rominger and Goldstein 2008). Ernest et al.

(2002) note that “removal of mountain lions may be the best option available for bighorn sheep populations in immediate danger of extinction due to predation by mountain lions”. Ernest et al. (2002) also determined that in some scenarios, more bighorn sheep were protected by removing lions that used bighorn habitat than only those that were identified as having preyed upon bighorn sheep.

Three herd units are currently identified as potential source populations for translocation animals based on current population sizes: *Mt. Langley, Wheeler Ridge,* and *Mt. Baxter.* For females, each of these three herd units exhibit different mortality rates, different levels of predation (Figure 1), and different population growth rates (Johnson et al. 2009). Sierra bighorn cause-specific mortality data for all collared animals, both male and female, shows a similar trend and suggests that lion predation is a major source of mortality (Table 1), especially given that habitat does not appear limiting. Resource selection modeling indicates that abundant habitat exists for Sierra bighorn in each herd unit throughout the recovery area (Johnson, et. al. 2005).

Although the absolute numbers of mortalities from predation are not large, the population of females in Sierra bighorn herd units is small (Figure 1, Table 2). The small size of populations makes Sierra bighorn especially vulnerable to the effects of predation. During 2008, survival of ewes in the Mt. Baxter herd declined substantially (Table 2). In winter 2008-2009, adult female survival was 55% amongst radio-collared individuals (Table 2) and 80% of the mortality was attributed to mountain lions. The population growth rate for Mt. Baxter calculated from demographic rates during 2008-2009 was 0.65 (indicative of a declining population). In 2009, for the Mt. Baxter herd unit, the total mortality rate for all females in the herd was 20%; over 75% of this was attributed to

predation. Mt. Baxter has the lowest population growth rate of the translocation source populations. We would expect it to have the highest population growth rate given the current habitat quality and the productivity exhibited in the 1970s (Wehausen 1983). This compares to a total mortality rate for females at Mt. Langley of < 9% and at Wheeler Crest of 0% during 2009. A population demonstrating low survival and reproduction is further at risk of extinction and cannot support removals for translocation. The habitat quality and and history of population levels at Mt. Baxter clearly indicate that a much higher carrying capacity exists for this herd unit. Consequently, removal of mountain lions is warranted to reduce the current level of predation on the Mt. Baxter herd and to ensure the availability of animals for translocation. During the 1970s and 1980s, the Mt. Baxter and Sawmill Canyon herds served as the source populations for all Sierra bighorn translocations.

Mountain lions in the eastern Sierra Nevada are distributed most densely in proximity to mule deer primary winter ranges. Consequently, the areas of highest use are adjacent to the occupied herd units of Wheeler Ridge, Sawmill Canyon, Mt. Baxter, and Mt. Williamson. There appear to be multiple reasons for the increase in predation in the Southern Recovery Unit during 2006 – 2009 (Figure 2). First, during 2000 to 2007 the Sierra bighorn population grew by >300% and much of this growth was in the Southern Recovery Unit. Second, the minimum adult lion population in and adjacent to the Southern Recovery Unit exhibited an increasing trend from 2006 to 2009. Together, these greatly increased opportunities for lions to discover and prey on Sierra bighorn.

Around the time that Sierra bighorn received emergency listing as federally endangered (U.S. Fish and Wildlife Service 1999), a suite of agencies in November 1999

released a final environmental assessment (EA) entitled “Predator Damage Management to Protect the Federally Endangered Sierra Nevada Bighorn Sheep”. The agencies included the U.S. Fish and Wildlife Service, the California Department of Fish and Game, the U.S. Forest Service, the National Park Service, and USDA Wildlife Services. The document notes that it is necessary to protect Sierra bighorn from predation and that it is considered a “critical” limiting factor for this taxon. A primary goal of the predator management being directed was “no further losses due to predation”. The EA notes that a likely number of 3-5 mountain lions per year would be removed and that this is not a significant biological impact. Since the formation of the Recovery Program, an average of 1 lion per year has been removed to protect bighorn sheep. The upper limit of lions considered for removal was 13 per year and this level was deemed a moderate but “low magnitude impact”. This upper level was considered potential but unlikely. Because of the large home ranges of mountain lions and the potential for recolonization from surrounding areas, the levels of lion removal proposed in the EA were considered low impact and temporary to the overall population of lions in the region. Intensive monitoring was expected to assess the effects of removals on the broader mountain lion population.

The expectation with recovery is to return the bighorn population to levels where individual herds can tolerate predation by mountain lions. Bighorn herds are always small relative to more abundant ungulate populations. Bighorn herds in proximity to mountain lions supported by alternate prey are only likely to persist when the bighorn herds exist as part of a connected metapopulation. A metapopulation is defined as a population of populations (herds) that undergoes periodic extinctions and colonizations.

When Sierra bighorn are recovered to the point where all of the herds exist as part of a fully functioning metapopulation, extinctions that occur as the result of stochastic predation events are able to be recolonized. In the absence of a healthy metapopulation, predation, that threatens the extinction of a herd or the availability of surplus animals for translocations, will be controlled by management.

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Table 1. Sierra Nevada bighorn sheep collared animal (male and female) annual mean mortality rates based on a cause specific mortality analysis for the Mt. Baxter, Mt. Langley and Wheeler Ridge herd units during the years 1999-2009.

Subpopulation	Lion	Physical Injury	Other	Unknown
Wheeler Ridge	0.050	0.010	0.005	0.033
Mt. Baxter	0.132	0.044	0.024	0.027
Mt. Langley	0.035	0.017	0.0	0.071

Table 2. Survival of adult female radio-collared Sierra Nevada bighorn sheep during 2005 – 2009 (standard error in parentheses).

Year	Mt. Langley		Mt. Williamson		Mt. Baxter		Sawmill Cyn		Wheeler Ridge		Mt. Gibbs		Mt. Warren	
	n	s	*n*	s	*n*	s	*n*	s	*n*	s	*n*	s	*n*	s
2005-2006	8	0.88 (0.12)			4	1.00 (0.00)	5	1.00 (0.00)	12	0.83 (0.11)				
2006-2007	17	0.94 (0.06)			3	0.67 (0.27)	5	0.60 (0.22)	18	0.83 (0.09)			3	0.67 (0.27)
2007-2008	16	0.75 (0.11)			6	0.67 (0.19)	4	1.00 (0.00)	16	1.00 (0.00)	3	1.00 (0)	5	0.40 (0.22)
2008-2009	12	0.75 (0.13)	5	0.60 (0.22)	11	0.55 (0.15)	10	0.70 (0.14)	16	1.00 (0.00)	3	1.00 (0)	2	0.50 (0.35)
Avg Across Yrs		0.83 (0.05)		0.60 (0.22)		0.72 (0.10)		0.83 (0.10)		0.92 (0.05)		1.00 (0.00)		0.52 (0.08)

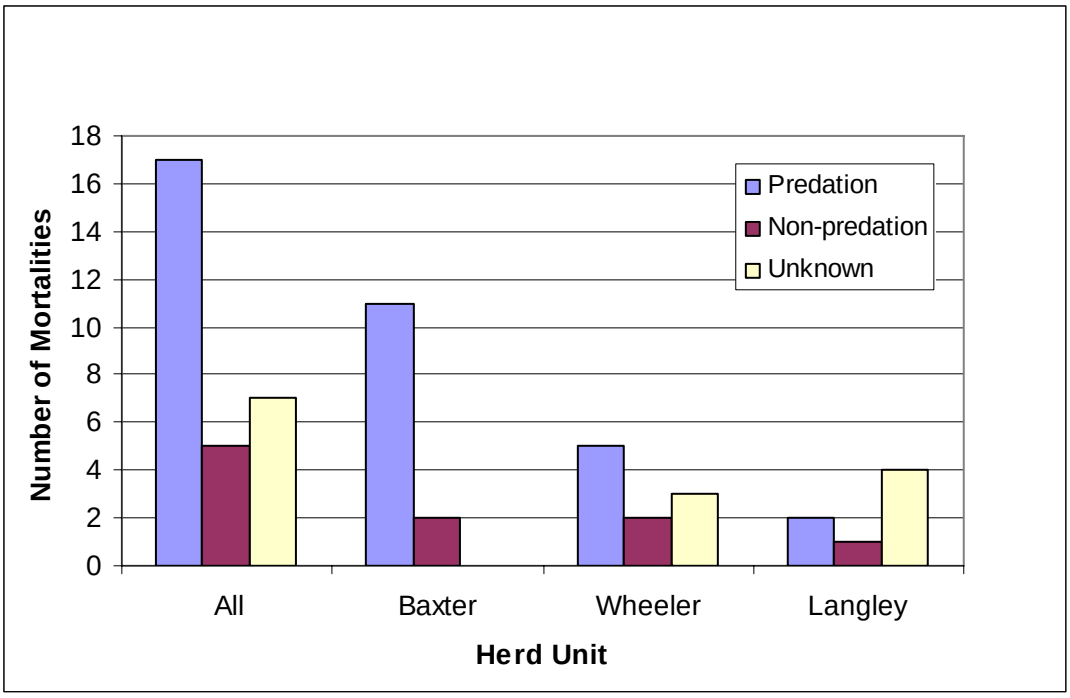

Figure 1. Sierra Nevada bighorn sheep known female mortalities for the Baxter, Langley and Wheeler herd units during 2003-2009.

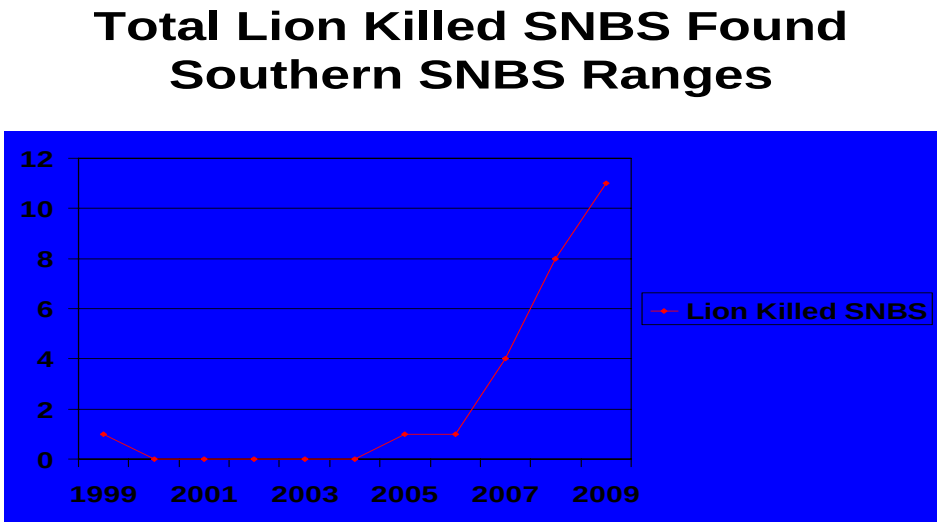

Figure 2. Number of Sierra Nevada bighorn sheep mortalities that were identified in the Southern Recovery Unit and determined to be preyed upon by mountain lions during 1999 – 2009.