QUARTERLY REPORT OF THE SIERRA NEVADA BIGHORN SHEEP RECOVERY PROGRAM

Photo by Tom Stephenson

APRIL – JUNE 2007

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CALIFORNIA DEPARTMENT OF FISH AND GAME

FOCUS OF PROGRAM

Recovery of bighorn sheep in the Sierra Nevada is dependent upon a number of management actions that are being implemented by the Recovery Program and various cooperating agencies. The primary actions being implemented at this time include: 1) continuing to accurately estimate population demographics and the factors that affect them, 2) minimizing the risk of disease transmission from domestic sheep to bighorn sheep, 3) implementing further translocations to expand the distribution of bighorn through reintroductions into historical habitat and to augment existing herds that have remained small, 4) continuing habitat enhancement projects, such as prescribed fire, in herd units that have experienced forest and shrub encroachment that has reduced visibility on formerly open ranges, and 5) continuing predator management in bighorn populations that may be impacted by higher levels of predation.

In addition to the various management actions implemented through the recovery program, weather plays a pivotal role in determining population growth and recovery through its effects on forage production and availability. Although we cannot control the effects of weather, it is imperative that we understand the role it plays in either benefiting or hampering recovery efforts. In order for the efforts of the Recovery Program to be successful, it is essential that we understand the dynamics of the natural system in which Sierra bighorn live. Consequently, considerable effort has gone into measuring the factors that limit the numbers of Sierra bighorn, whether they are climate, habitat, predation, or an interaction of all of those factors. We will continue to learn as we move forward with recovery and employ an approach that allows us to adapt our activities as new information is gathered.

BIGHORN DEMOGRAPHY

Survival rates of Sierra bighorn ewes for the 1st and 2nd quarters of 2007 were 98% and 94%, respectively. Ram survival was 90% for January – March 2007 and 100% for April – June 2007. During the 1st two quarters of 2007, we observed 8 mortalities of radio-collared bighorn sheep, 5 (3 rams and 2 ewes) were attributed to mountain lion and 3 ewes died of unknown causes but at least 2 may have been related to old age. The high adult survival observed during the past year support further support the notion that the population of Sierra bighorn continues to increase in size.

Poor survey opportunities occurred during winter 2006/2007 because many bighorn sheep remained in the alpine at high elevations (see discussion below). However, we were successful in conducting reliable surveys in several herd units last summer. A population estimate of 386 for 2005/2006 was based on good survey conditions. Given the generally high adult survival during the past year, it is likely that the population of Sierra bighorn now exceeds 400 individuals (see attached status report). Sierra bighorn currently occupy 8 herd units (Figure 1) including Mt. Gibbs, Mt. Warren, Wheeler Ridge, Sawmill Canyon, Mt. Baxter, Bubbs Creek, Mt. Williamson, and Mt. Langley.

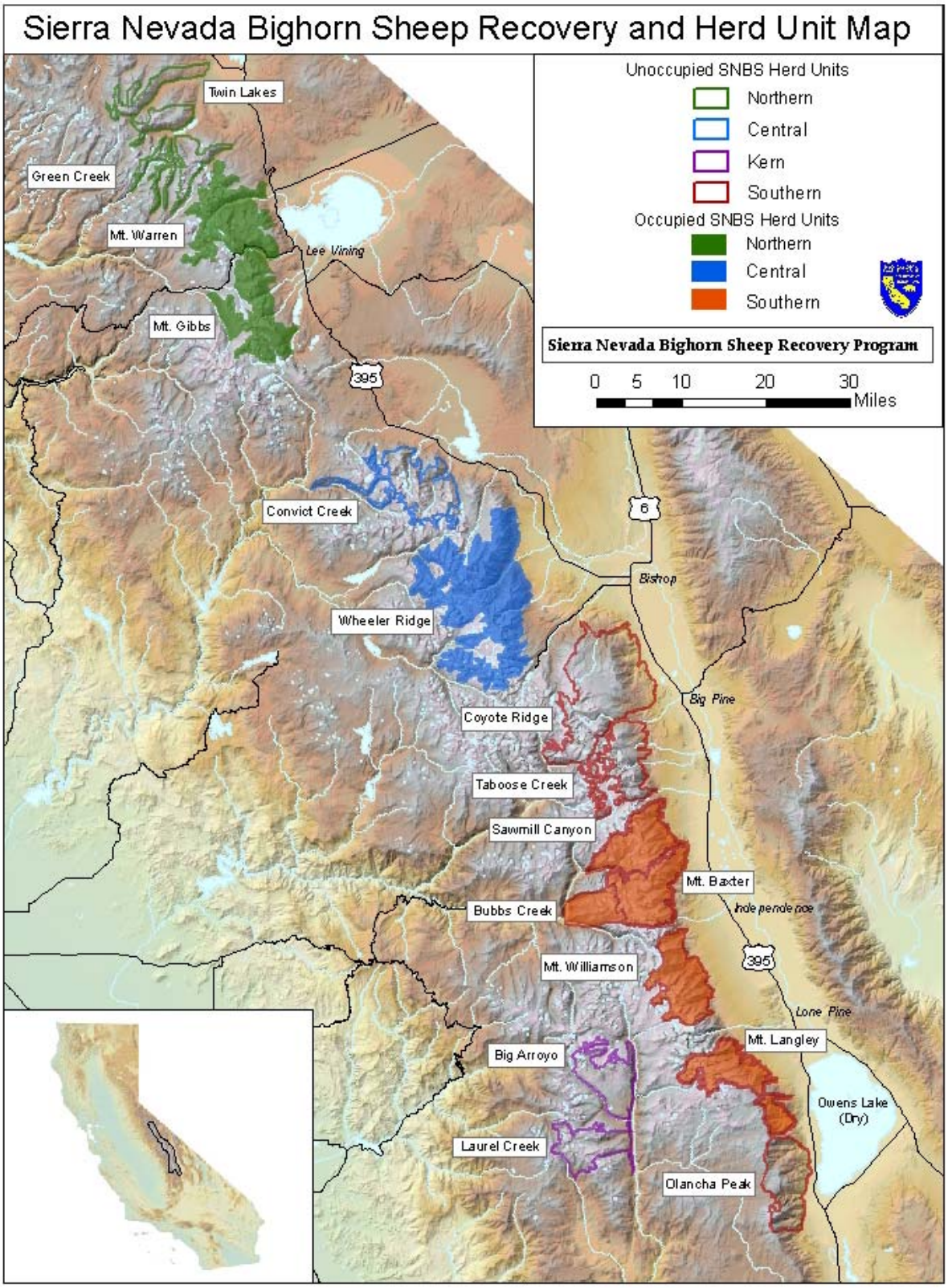

Figure 1. Map of the recovery area for Sierra Nevada Bighorn Sheep.

LAMB PRODUCTION

In recent years, the Wheeler Ridge herd unit has offered the best opportunity to quantify lamb production near the time of birth. In addition, there is an adequate sample of radio-collared ewes (16 in 2007) in the unit that permits continued monitoring of the status of lambs throughout the summer season (Figure 2). Since 2002, lamb production by radio-collared ewes has ranged between 64 and 86% on Wheeler Ridge (Figure 3). The proportion of lambs belonging to radio collared ewes surviving to 6 months of age and in the general population have ranged between 53 – 71% and 46 – 61%, respectively. At this point results are preliminary and it is difficult to say whether the differences in lamb production and survival during the last 6 years are statistically significant or are just a result of random variation. At any rate although lamb survival on Wheeler Ridge appears to have declined during recent years, levels remain sufficient to permit continued population growth. We continue to investigate whether lamb mortality is a function of nutrition, predation, or some other factor.

Photo by Dennis Jensen

Figure 2. Radio-collared Sierra Nevada bighorn ewe nursing a lamb on Wheeler Ridge during May 2007.

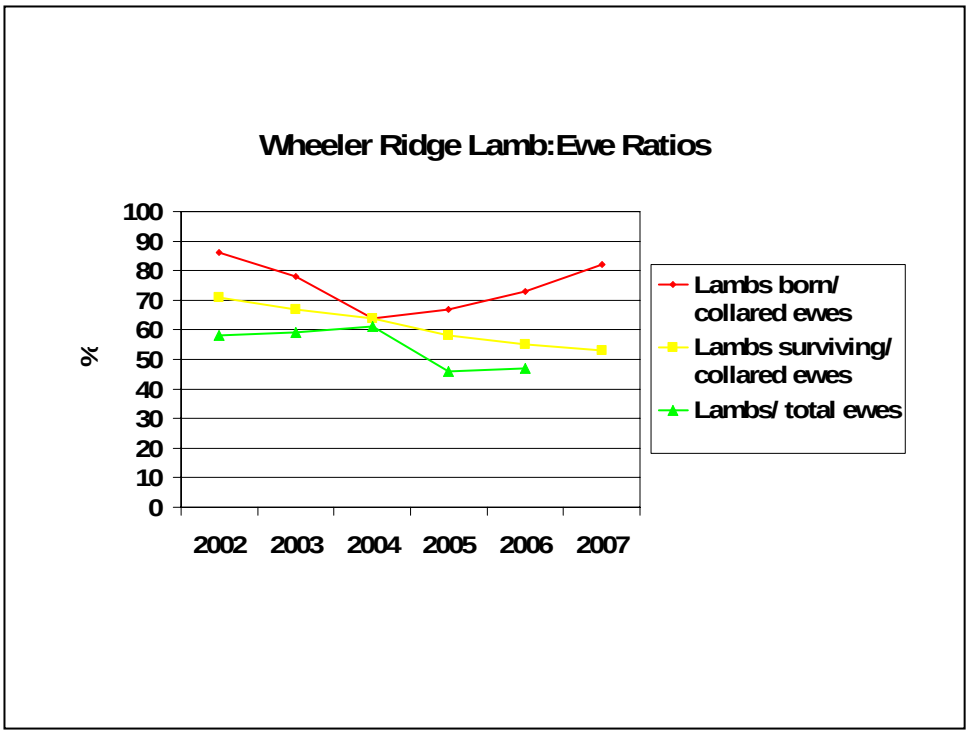

Figure 3. Ratios of lamb production and survival in the Wheeler Ridge herd unit, eastern Sierra Nevada, California, during 2006/2007.

CLIMATIC CONDITIONS

Climate has a notable effect on numerous aspects of bighorn ecology. In particular, precipitation determines the biomass of forage production during the growing season (which varies by elevation) and snowfall determines its availability during winter. During the last few years, we have seen precipitation in the eastern Sierra Nevada shift from near record high snowfall to extreme winter drought. For example, weather data from the Mt. Langley herd unit (see Figure 4) illustrates that during winter 2005/2006 snow depths exceeded 70 inches, whereas during winter 2006/2007 snow depths barely exceed 20 inches. This weather pattern resulted in some interesting behavioral responses by Sierra Nevada bighorn sheep that are discussed in the next section.

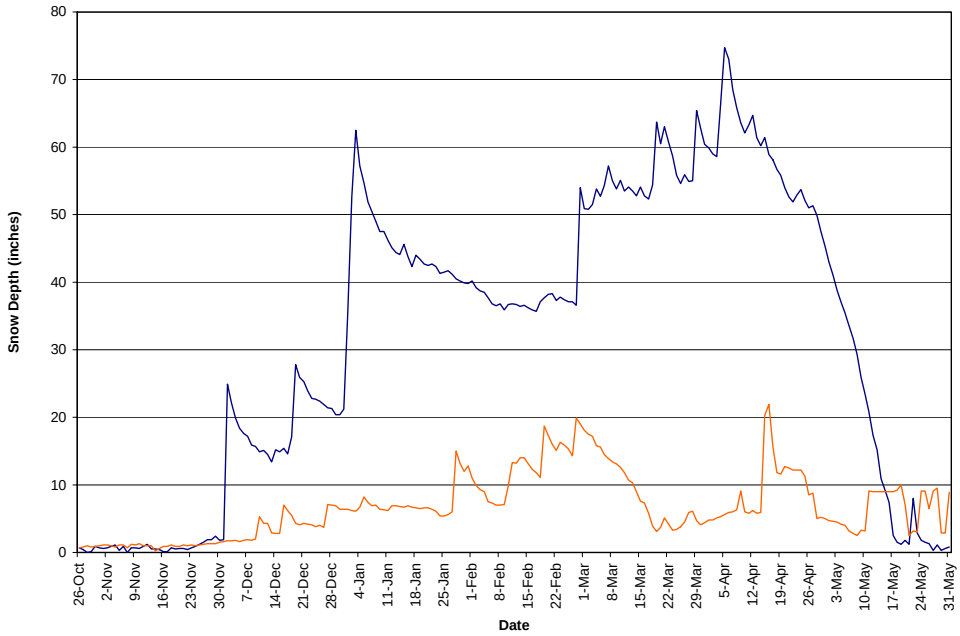

Figure 4. Snow depth measured in the Cottonwood Lakes Basin as an index to snow conditions in the Mt. Langley herd unit during winter 2005/ 2006 (blue line) and 2006/2007 (red line). Snow fall during 2006/2007 was about 1/3 of that seen in 2005/2006.

BIGHORN DISTRIBUTION

We were able to directly monitor movements of bighorn sheep because of the large number of individuals wearing radio-collars. The data presented in Figures 5 and 6 is derived from conventional VHF telemetry collars that permitted locations to be obtained from aircraft. Most of these animals also wore GPS collars that store and collect data that will be downloaded when the collars are retrieved upon automatically dropping off. During the heavy snow winter (2005/2006), bighorn in the Mt. Langley herd moved to lower elevations throughout the winter and by March were commonly observed below 7000 feet. In contrast, during the dry winter (2006/2007), bighorn remained above 12,000 feet during the entire winter. Figure 6 shows that during heavy snow years, bighorn move to lower elevations to the east. During the dry year, many bighorn spent much of the winter within the boundaries of
Sequoia-Kings Canyon National Park. The patterns observed in the Mt. Langley herd were repeated among all of the other Sierra herds that contain radio-collared bighorn and were particularly notable in the herds that usually spend winters on lower elevation (<7,000 feet) sagebrush steppe ranges such as Wheeler Ridge, Mt. Baxter, and Sawmill Canyon. We hypothesize that bighorn remained high during the dry winter because snow did not force them to move out of alpine terrain and the lack of precipitation resulted in a lack of forage green-up that typically occurs by February.

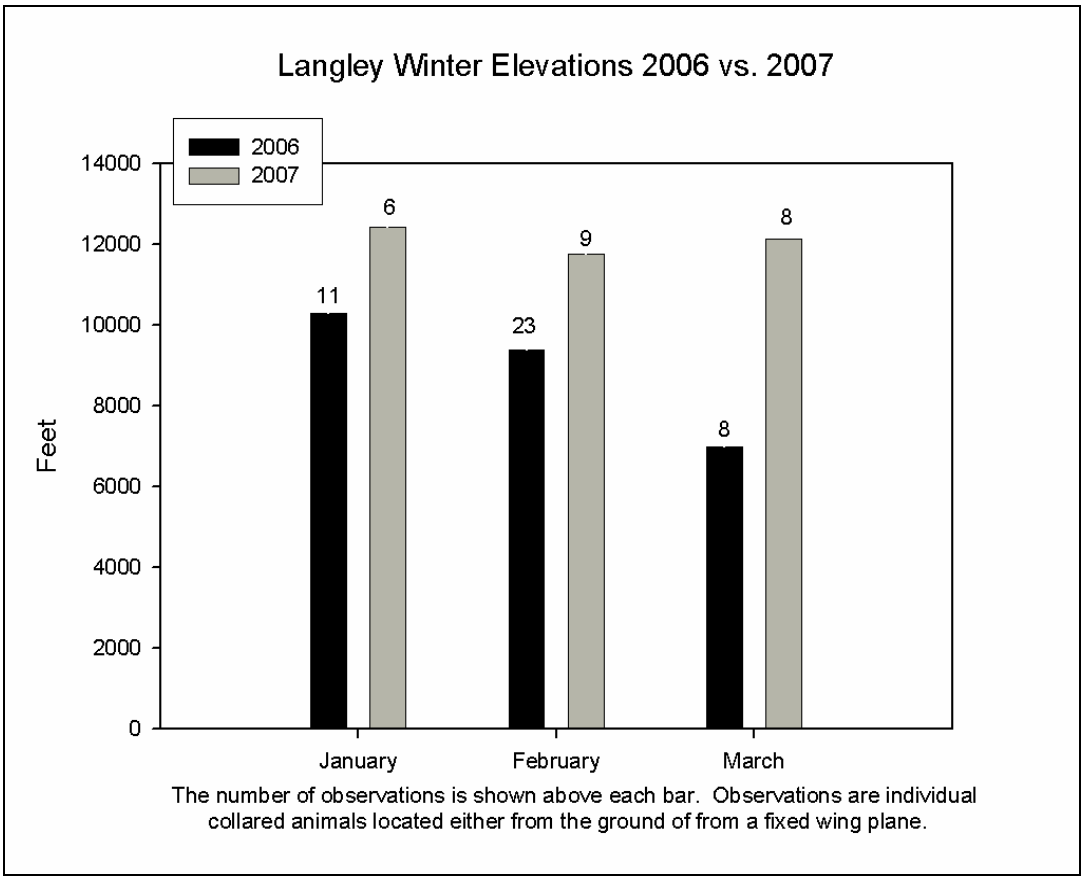

Figure 5. Elevations used by radio-collared Sierra Nevada bighorn sheep in the Mt. Langley herd unit during January – March 2006 and 2007. As a result of the low snowfall winter in 2007, bighorn remained at elevations above 11,000 ft. throughout the winter.

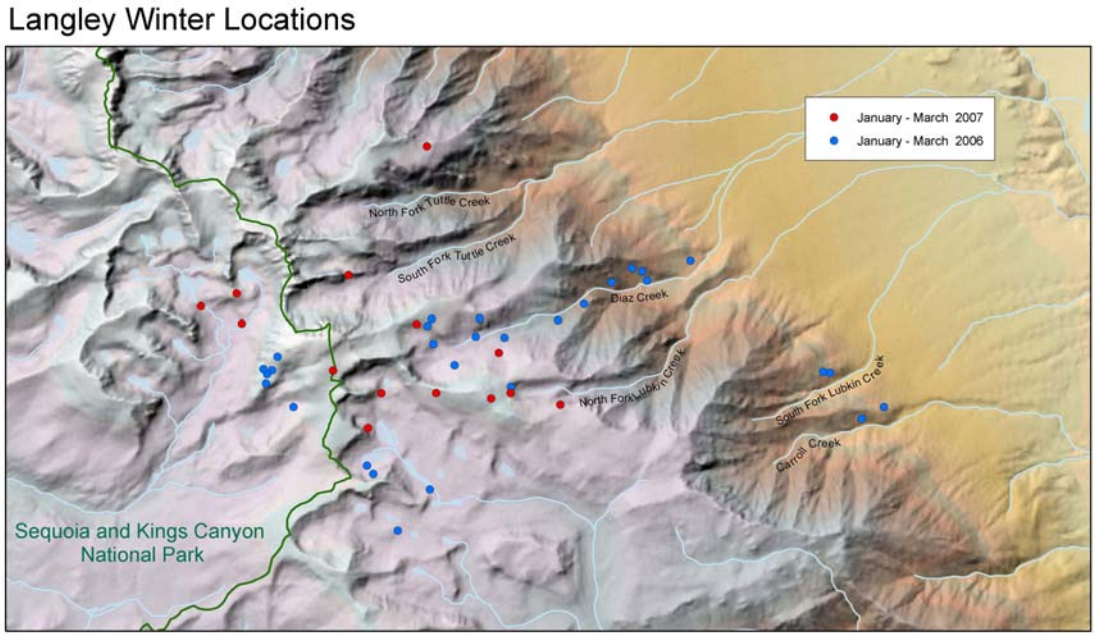

Figure 6. Locations used by radio-collared Sierra Nevada bighorn sheep in the Mt. Langley herd unit during January – March 2006 and 2007. Rather than moving to low elevation sagebrush winter range at the base of the Sierra escarpment, bighorn remained in alpine range.

PREDATOR MONITORING

Since April of 2007 the predator program has captured four new adult mountain lions; one female and three males, and fitted them with radio collars. One of the males was captured close enough to SNBS winter range to be fitted with a GPS collar, while the others received conventional VHF collars. In addition, one adult female that has been monitored since 1994 was captured and recollared. In the future, all mountain lions captured will be fitted with GPS collars to facilitate data collection and improve location accuracy.

Monitoring of an adult female mountain lion in the Mono Basin area revealed a den with three kittens, one male and 2 female, approximately 14 days old (Figure 7). Only one of the kittens appeared healthy, a female, while the other two were in poor condition.

Predator program personnel investigated mortality signals from two SNBS in the Baxter Herd and determined that they were killed by a mountain lion. It is unknown which mountain lion was responsible as no radio-collared lion was heard in the immediate area, and none of the tracks identified near the kills were in adequate condition to be measured. One mountain lion was trailed in the area shortly after the kills were located, but his tracks never went into the canyon toward the kills. There are currently five different mountain lions that are known to have occupied that area at different times.

Population trend data for the mountain lions indicates that there has been a relatively low density, stable population since November of 2000 in Round Valley (Figure 8.) These data represent the mean number of adult mountain lions located within the Round Valley area during all flights conducted from November through April each year. The values presented are a minimum because they are based solely on collared mountain lions however, this index is valuable because a constant effort to collar all lions in Round Valley has been ongoing since 1992: therefore, in all years there was a small number of uncollared individuals not detected during some flights. Our experience has suggested that this index does, in fact, track the relative mountain lion sign and activity we see all along the eastern Sierra Nevada.

Comparison of the mean elevation of bighorn sheep kills located among months indicated a significant difference (Figure 9: $P < 0.001$), however sample sizes are still too small to consider this test indicative of mountain lion predatory behavior, and there is likely a bias against finding kills at the higher elevations when GPS coordinates are not available. It is interesting to note however, that SNBS were killed by lions as high as 11,621 feet (3543 m).

Photo by Jeff Davis

Figure 7. Mountain lion kittens in the Glass Mountains during summer 2007.

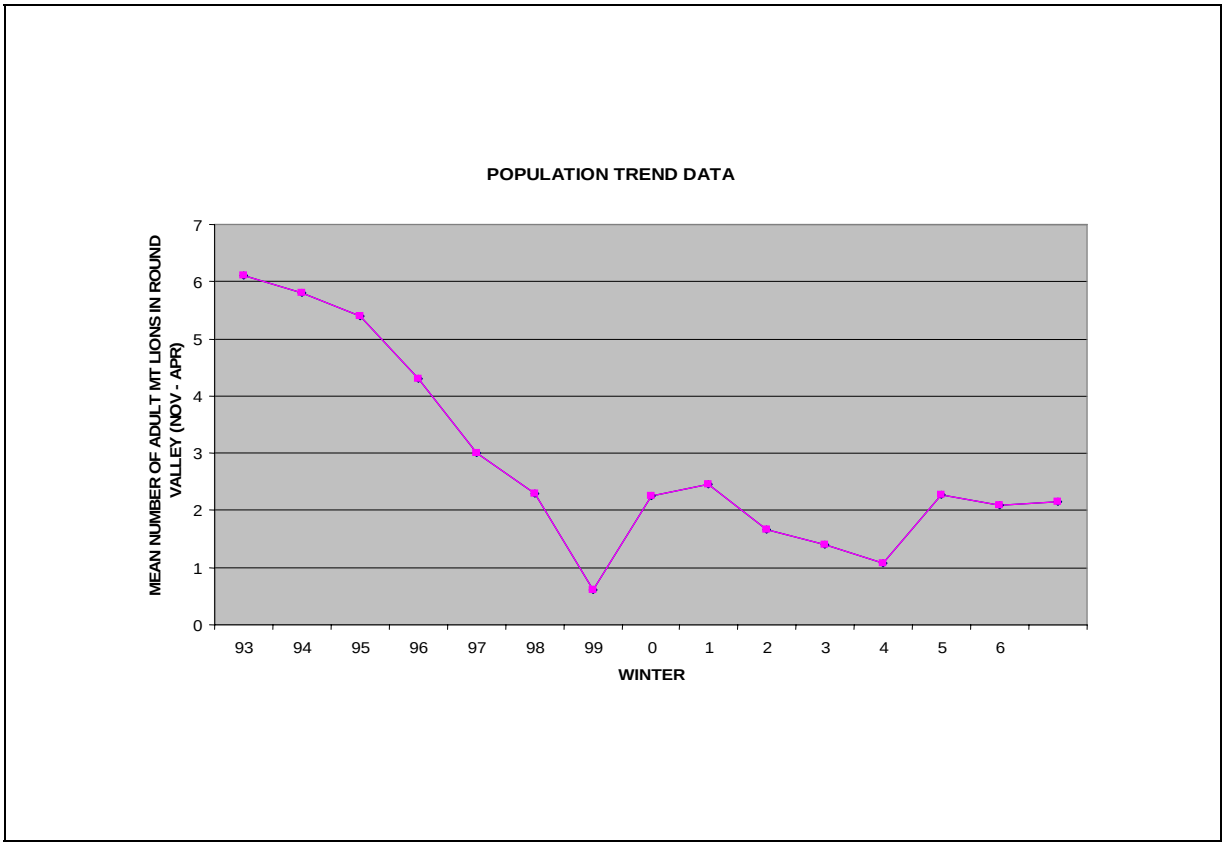

Figure 8. Population trend for mountain lions in Round Valley, eastern Sierra Nevada, during 1993 – 2007.

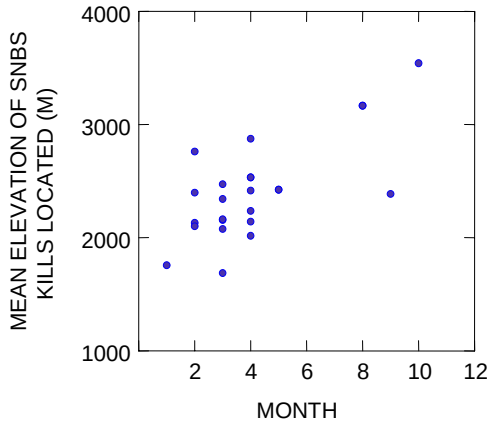

Figure 9. Elevation of Sierra Nevada bighorn sheep preyed upon by mountain lions by month during 2001–2007.

RECENT PUBLICATIONS BY PROGRAM PERSONNEL

Cook, R. C., T. R. Stephenson, W. L. Myers, J. G. Cook, and L. A. Shipley. 2007. Validating predictive models of nutritional condition for mule deer. Journal of Wildlife Management 71:1934-1943.

PERSONNEL AND ACKNOWLEDGEMENTS

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