

Sierra Nevada Bighorn Sheep Herds: 2002 Status¹

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December 2002

This report summarizes population information on bighorn sheep herds in the Sierra Nevada developed since the last report was produced one year ago. That 2001 report provided a detailed historical summary of demographic data developed since the early to mid 1990s, depending on herd. This report will summarize only as much past information as is needed to understand the newest data. The information in this report is a distillation of information collected by Dave German, Dennis Jensen, Tom Stephensen, Jeff Villapique, and myself.

The past year was not generally favorable to the development of demographic information on bighorn sheep in the Sierra Nevada. At least a couple of reasons are involved. Winter conditions did not favor concentrations of sheep at low elevations in late winter, which historically have provided some of the best census opportunities, especially for larger herds. Winter began in late November of 2001, which was notably earlier than in the previous three years. While it caused some early use of low elevation winter ranges by sheep in the Wheeler Ridge herd, this did not occur elsewhere. The early winter snow storms continued through much of December, but winter largely ended then. In late winter when sheep are most likely to descend to winter ranges, south-facing slopes were largely bare of snow to high elevations, providing sheep with many snow-free alternatives. In 2001, helicopter surveys at the end of winter provided a productive tool to help focus ground efforts. In 2002 that tool was not available.

Recent rapid increases in herd sizes also played a role in the success of monitoring efforts in 2002. Increased herd sizes mean that more sheep must be observed well enough to be correctly classified by sex and age categories and individual marks in a short time period to provide good minimum counts. The probability of this occurring has been declining with each increment of population increase which is evident in a decline in the frequency of good count data for most herds.

Below is a summary of pertinent information, organized by the herd units as defined in the Draft Recovery Plan. Where herd units include multiple female demes, these are discussed separately. Monitoring efforts have been focused on determining numbers of females and measuring reproductive success.

I. Mount Langley Herd Unit

The only sheep in this herd unit observed during winter were two males seen on the Carroll

¹ completed as partial fulfillment of interagency agreement P0260003 with the California Department of Fish and Game.

Creek winter range from a helicopter during a deer survey in early January. Summer efforts were delayed due to thick smoke in the area from an extensive and long-burning forest fire in the Kern River drainage. Subsequent summer efforts were successful in finding only half of the expected females in this herd. Based on data from the past couple of years, as many as 16 adult females and 10 yearlings (5 of each sex) were expected in this herd in 2002. What was observed were only 8 adult females, 2 yearling females, 5 lambs, and 2 yearling males. Multiple additional trips failed to find more sheep, but there was ample evidence that they existed. Based on genotyping of lambs in 2001, three additional yearling females and 3 more yearling males potentially exist, in addition to eight more adult females.

Fecal pellets from lambs were collected for genotyping from multiple locations during summer and fall this year. Data for 16 lamb samples have produced eleven different lamb genotypes. Numbers of lambs accounted for in each successive year in this herd as it has grown, beginning in 1996, are: 2, 5, 1, 6, 9, 10, 11. The low number of lambs in 1998 followed a particularly long and snowy winter in which females may have lost considerable body condition compared with other winters since 1995.

This year was the second consecutive year in which notably incomplete counts of the Mount Langley herd were obtained. Extra efforts should be made in the next year to attempt to make this data base more current. Environmental conditions since the 1997-1998 winter have been very favorable to adult survival and reproduction. Given that situation, it is possible to project a current upper limit for this population. Six years ago, in 1996, the known adults and yearlings in this herd totaled 6 females and 11 males. From 1996 to 2001, known lamb production has totaled 16 females and 17 males. In the absence of mortality, the population would contain 21 adult and yearling females and 29 adult and yearling males for a total of 50 adults. Given the potential longevity of females, 21 females may actually exist. In contrast, one male is known to have died from predation since 1996, and it is quite unlikely that all other males have survived, given the survivorship patterns of males. Nevertheless, it is reasonable to expect that this year's lambs have put this population over 50. A current conservative population estimate of 50 is reasonable.

II. Mount Williamson Herd Unit

No members of this herd were observed in winter or summer during the past year. A check of the Shepherd Creek winter range on 11 March found evidence that about 4-5 sheep had spent perhaps 2 weeks there, having departed only about a week earlier. A summer investigation in late August found very sparse evidence of sheep use above the South Bairs Creek cirque, in contrast to the previous year. Instead, considerable recent sign was found on the north ridge of Mount Williamson and upper Williamson Creek around the lowest lakes. Fecal samples from lambs were collected from both sides of Mount Williamson. Data on microsatellite genotypes for 20 samples indicate 7 different lambs.

The Mount Williamson population continues to defy efforts to make direct counts. Demographic information for the past 6 six years has been based entirely on genetic data from fecal samples. For 1997-99, 16 different genotypes were identified, which included 9 adult females, 4

female lambs, 2 male lambs, and 2 other (probably yearling) males. Unfortunately, sampling of this herd was inadequate in 2000. The following winter, one lamb was observed in the Shepherd Creek winter range, but how many other lambs might have existed in the herd that year is unclear. A young female that was born in 1998 is known to have died on Shepherd Creek winter range in 2001. Samples collected in the summer of 2001 produced 7 different lamb genotypes, of which 5 were male. These data suggest that the reproductive base at Mount Williamson could be 15 or more adult and yearling females. With the addition of this year's lambs, it is likely that this herd now numbers more than 30 sheep. Thirty would be a reasonable conservative estimate for 2002.

Climbing guide SP Parker reported finding fresh droppings and beds of sheep on the top of the north ridge of Mount Williamson during a winter ascent this year. This is consistent with field evidence since 1996, which points to the north ridge as the current center of distribution of this herd. It would be worth allocating helicopter time to this ridge system in late winter to see if sheep can be found.

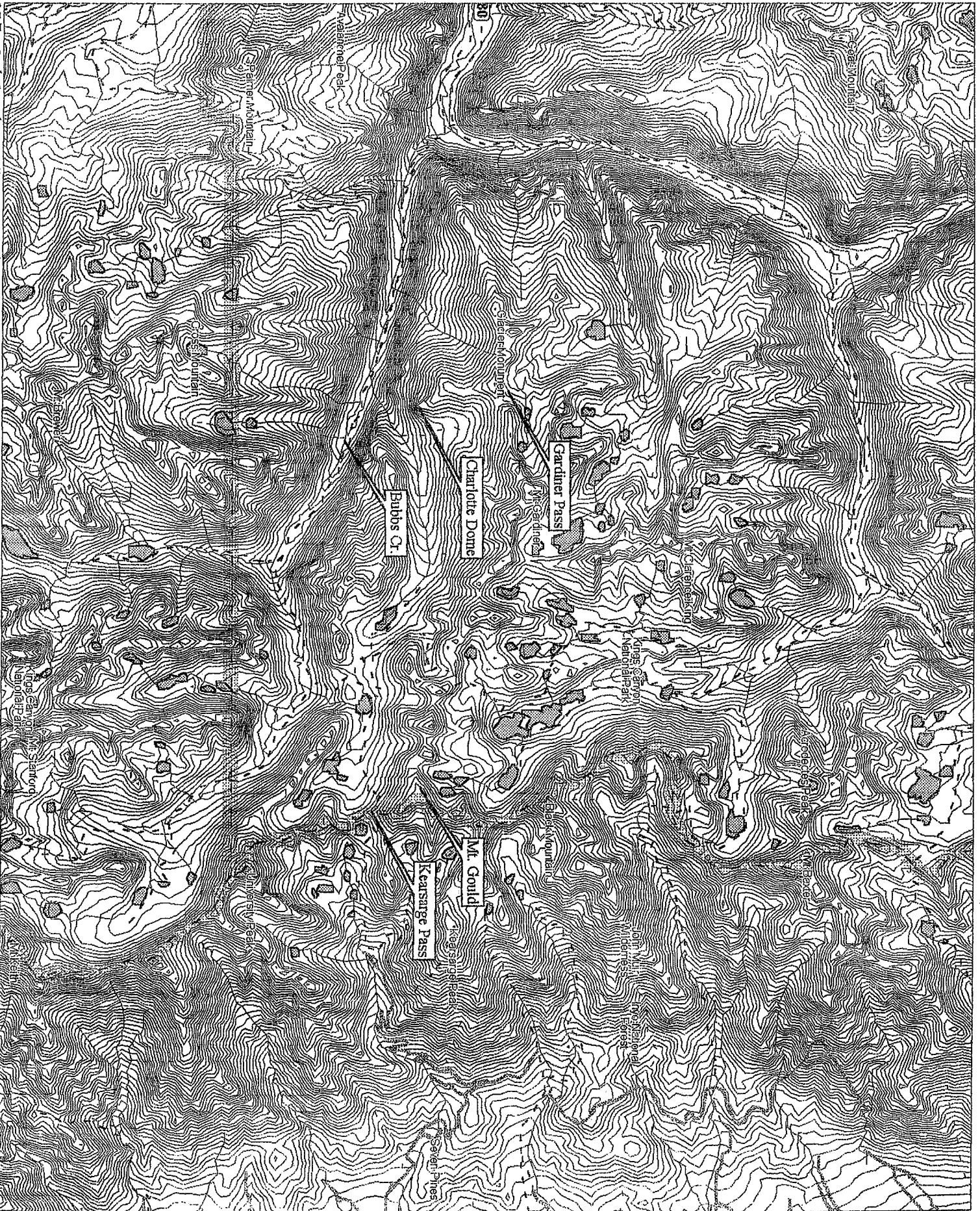
III Mount Baxter Herd Unit.

Mount Gardiner Group

In early August, mountain guide SP Parker contacted us about 11 females, lambs, and associated sheep that he observed at the base of Charlotte Dome. Charlotte Dome is a rock pinnacle that sits north above Bubbs Creek about 6 miles west of Kearsarge Pass, and about 5 miles west of known female range (see map). This area was surveyed on multiple trips this past summer in an effort to ascertain whether this was a recent range expansion or an old, but unknown, group with a distribution including the rock buttresses above the lower reaches of Bubbs Creek and the South Fork of the Kings River to the west of Charlotte Dome. Key information relative to this question was the pattern of sheep use nearest to Charlotte Dome and Bubbs Creek. It has been a consistent pattern that females develop summer ranges in the suitable habitat that is closest to their winter ranges. This expands as population density necessitates more summer range.

For sheep using Bubbs Creek and Charlotte Dome, access to summer alpine range is along a spur ridge north above Charlotte Dome that connects to a primary ridge system connecting Glacier Monument and Mount Gardiner (see map). From the top of the spur ridge above Charlotte Dome, the closest suitable (and excellent) summer habitat for sheep lies immediately north in a lake basin north of Gardiner Pass. Additionally, there is a small area of potential summer habitat at the top of the drainage north of Glacier Monument. If a herd of sheep using Bubbs Creek has existed for a long time undetected, their summer range would be expected to include this nearest excellent summer habitat. If this population is the result of a recent range expansion from the Mount Baxter herd via Mount Gardiner, these closest alpine habitat patches might not receive summer use because a summer range was already established in the Mount Gardiner area.

Surveys this summer found the following: (1) ample sign of the sheep observed by SP Parker at Charlotte Dome; (2) weathered sheep droppings from past years at and immediately west of Charlotte Dome; (3) no sign of sheep use in the lake basin immediately north across Gardiner Pass;



3-D TopoQuad Copyright © 1999 DeLorme Inc. Vermont, VT 05496
 1 km Scale: 1:112,500 Data: WGS84

(4) no sign of sheep use of the potential habitat in the drainage immediately north of Glacier Monument; and (5) ample sign of sheep high on Mount Gardiner along with the carcass of a 3-year old male on its south side. This information suggests that the Charlotte Dome area is a recent colonization. This is also supported by a lack of reported observations of sheep in the region of lower Bubbs Creek in the past, nor females west of the Rae Lakes drainage.

Additional past observations have bearing on the question of the origin of this female group. For decades, males from the Mount Baxter herd have been known to use the Sixty Lakes and Gardiner Basins, including Mount Gardiner, as part of their summer range. In September of 1999, I investigated a report of thirteen sheep in the Gardiner Basin because it was notably more than the expected number of males using that area. To my surprise, I found clear evidence of lambs, thus also females, neither of which had previously been known to use habitats on the west side of the Rae Lakes drainage. Later that same month in 1999 I had the chance luck of meeting the hiker who had seen the group of 13 sheep, and she verified that it included everything from lambs to mature males. That observation was notable as the first evidence of females using that region.

From the mid 1970s to the mid 1990s, adult females and associated younger sheep were well documented in summer in the area immediately north of Onion Valley and Kearsarge Pass from Kearsarge Peak to Mount Gould. After the Mount Baxter herd sheep began avoiding winter ranges in 1987, we found evidence that a small number of females in this region remained there year round; occasionally they could be found low above the road to Onion Valley in April. In the second half of the 1990s this changed, and by 1997 we could no longer find evidence of females using this area during any season. The small amount of sign of sheep found in the Kearsarge Peak area in recent years has suggested males, and I verified this in the laboratory from droppings collected in 1998 and 2001. Yet, females have continued to use adjacent Black Mountain and Mount Mary Austin every summer, which had been thought to be the same group of females that used the Kearsarge Peak area. This has remained a biologically unexplainable change in habitat use, given the close proximity and connectivity of these two areas.

The female group on Mount Gardiner appears to be the missing link. The simplest explanation that accounts for all of the above information is (1) the Kearsarge Peak group of females was independent of the Black Mountain group; and (2) about 1996 the Kearsarge Peak group moved west and took up residence around Mount Gardiner. These two areas are directly connected by excellent sheep habitat; thus, this expansion is not exceptional. Perhaps this occurred first during years with mild winters, with the sheep abandoning their old range east of the Sierra Nevada crest after discovering that they could drop west down to the steep south-facing habitat above Bubbs Creek to find winter range that is largely snow-free.

So far I have developed genetic data on 11 microsatellite loci for 10 samples representing 7 different individuals (incl. 2 lambs) from dropping collected at Charlotte Dome. These samples contain the alleles typical of the larger Mount Baxter area, which is consistent with a recent range expansion.

The discovery of the Mount Gardiner deme raises questions concerning the level at which

demographic restructuring may occur in sheep populations in the Sierra Nevada. Population restructuring in the Sierra Nevada has been evident for decades on the basis of geographic patterns of naturally marked sheep and demographic data. The apparent distinction between the Black Mountain and Kearsarge Peak groups of females suggests that in some situations restructuring may occur at a yet finer scale than we have previously postulated. There remains a question of whether the female group living in the Mount Gardner area should be treated as another herd unit or as another group (deme) within the Mount Baxter herd unit. This should await further characterization of their habitat use patterns.

Black Mountain Deme

During the past two years there has been uncertainty about the size of the Black Mountain deme because of the high reproductive output. Field observations suggest that in the summer of 1998 this group was at a low of 4 adult females, 1 yearling female, and no lambs. In each of the summers of 1999, 2000, and 2001, a group of 5 females has been found on Black Mountain, some of which were recognizable as the same sheep. In 1999 and 2000 they were accompanied by 4 lambs, which increased to 5 lambs in 2001. In an attempt to establish a potential number of breeding females in this area, I genotyped fecal samples collected from lambs and yearlings in October 2000 and from the five adult females observed in 2001. The yearling samples from 2000 yielded the expected 4 genotypes (2 female, 2 male) none of which matched the 5 adult females seen in 2001. Lamb genotypes from 2000 totaled 5 (2 female, 3 male), which is one more than what was observed in the field. These data indicate that in 2002 there could be 9 females old enough (2+ years) to produce lambs.

This summer two groups of sheep were observed on Black Mountain: (1) 6 adult females, 1 yearling female, 5 lambs, and 1 yearling male on July 16; and (2) 3 adult females, 1 lamb, and 1 yearling male on August 17. The lamb seen on August 17 had no visible horn growth, which was not consistent with the lambs seen a month earlier, making it an additional lamb. Since the July group contained only one adult female without a lamb, the August group probably accounts for at least two females in addition to the July group. These two groups combined totaled 9 adult females, which is the number expected on the basis of genotypes; thus, this sampling may have sampled all reproductive age females on Black Mountain.

Mount Baxter Deme

Nine adult females, 7 lambs, 3 yearling females, and 2 yearling males were documented in this deme during the summer of 2001. Those totals were 1-3 females and 1 yearling lower than expected on the basis of prior data. In late March this year, a count of 10 females, 7 lambs (4 female, 2 male, 1?), 2 yearling females, and 1 yearling male was obtained one day on winter ranges in Black and Thibaut Canyons. These observations accounted for one of the females missing in summer, but were short a yearling of each sex relative to data from the previous summer. In late July this year three groups seen in one day in the Baxter Pass region provided a total count of 11 adult females, 4 yearling females, 3 yearling males, and 5 lambs. While this accounted for all known lambs from the previous year, it again did not account for all potential females. Data from two automated video

cameras that filmed sheep on a natural mineral lick on Baxter Pass from July 26 to October 5 did not provide data that would increase numbers of sheep in any sex/age classes above what was observed in July.

IV. Sawmill Canyon Herd Unit

Field data for this herd unit have been insufficient in recent years. Winter range observations documented 6 adult females in 1997, and that same number was counted in the summer range in 1999. Field data have not determined whether the number of females has exceeded 6 in recent years, but genotypic analysis of excellent fecal collections from the summer range in 2001 identified 6 different lamb genotypes. Consequently, more than 6 females have been expected to exist.

I recently genotyped 24 samples of adult and yearling droppings collected from 1999 to 2001 north of Sawmill Canyon (Mount Cedric Wright to Mount Wynne) on high elevation ranges used by females from the Sawmill Canyon herd, with the following preliminary results. Samples from 1999 produced 5 different adult female genotypes and 1 female lamb genotype, which matched the composition of the group I sampled at Mount Wynne. My sampling the following year identified 2 new adult female genotypes, and two female lambs, while two additional female genotypes matched ones sampled in 1999. Adults sampled in 2001 added 3 new female genotypes. Two additional female genotypes were identified from droppings attributed to yearlings in 2001, and one of those matched a lamb sampled in 2000. A yearling male also sampled in 2001 brings the 2000 lamb crop to at least 4. In total, this sampling identified 12 yearling and adult female genotypes. There may be additional females not yet sampled, but there is also no guarantee that all of the females sampled were alive in 2001. It does seem clear that this herd unit has contained more females than the 6 known from ground observations in 1999. If additional female lambs identified genotypically survived to adulthood, which is likely given the high lamb survivorship during those years, the number of females in the Sawmill Canyon herd unit may have been 15 or more in 2001. Yearlings in 2002 could increase that yet further.

During the past winter, 13 different sheep were observed in the Sawmill Canyon winter range: 4 adult females, 1 yearling female, 2 lambs, 1 yearling male, 2 2-year old males, and 3 older males (ages: 4, 4, 6).

No summer data were developed this year due to an early October snowstorm that terminated a trip before any productive investigations could take place.

V. Wheeler Ridge Herd Unit

The Wheeler Ridge herd is the largest in the Sierra Nevada and consequently a challenge to development of good data on total numbers. During the past winter this appeared to be the one population that might yield a good count as a result of the early snows that began in late November. Sheep were already moving into front country winter ranges by early December and significant census efforts began in December. However, it was evident from count totals and collared sheep that a significant portion of the sheep remained high during that early winter period. One of the 4

Females with functional collars did not appear in upper Pine Creek until March 8. Census efforts were then complicated when sheep that had moved to the low front country winter range above Round Valley in December had already returned to Pine Creek by late January. This pattern was very different from what has been observed beginning in 1999 when we began observing regular use of front country winter ranges again. During 1999-2001, sheep moved out of Pine Creek beginning in late January and returned in March. During 1999-2001, there were also distinct female groups that remained separate for the winter period when census efforts took place. With the different habitat use pattern this past winter this was not a reliable aid for much of the winter.

Table 1 lists the best minimum total counts developed from December to March. In total numbers the best count occurred during December when 57 sheep were counted. However, the highest lamb count occurred in March, while the highest count for 2-year old males was in January. The higher counts for those two categories brought the minimum total up to 63 sheep, which is lower than the number counted the previous year.

During the previous winter we could account for 19 adult females, 8 yearling females, 17 lambs (6 female, 11 male), 4 yearling males, and 21 older males for a total of 69. That count was thought to be short up to 3 females. Thus, the numbers expected this past winter, including yearlings, were 33 or more females, and up to 36 males. Similarly, with the increased reproductive base, the number of lambs was expected to rise to 20 or more. In short, what was counted was 65-75% of what was expected. Given the environmental conditions, there was no reason to expect that the missing sheep were dead. Instead, it is probable that there was a persistent pool of sheep at higher elevations where they are not available to be counted.

Table 1. Best counts for the Wheeler Ridge herd, December 2001 - March 2002.

Dates	adult females	yearling females	total females	lambs	yearling males	2-yr. old males	older males	total
12/18-24	20	4	24	11	6	3	13	57
1/29-30	20	2	22	12	3	5	1	43
2/4-6			16	12				37
3/7-9			20	15	6	4	7	52
maxima	20	4	24	15	6	5	13	63

The census conditions this past winter were perhaps worse than average, but it should be recognized that ideal winter conditions for actual or near total counts of large herds have never occurred in consecutive years since the mid 1970s and typically have been punctuated by multiple years of sub-optimal census conditions. This is the primary reason why reconstructed population figures have been used since the 1970s, as well as the reason why the draft recovery plan does not call for annual counts once herds reach sizes of the Wheeler Ridge herd.

Efforts this past spring, summer, and fall at Wheeler Ridge were focused largely on determining the reproductive status of collared females. Seven sheep were caught in Pine Creek under a drop net in 1999. The four adult females received radio collars, and a female lamb and two young males received only ear tags. During the past winter season, four females were caught and collared, two under a drop net and two net gunned from a helicopter. The two caught under the drop net were recaptures of females caught in 1999, but included the female with only ear tags. Consequently, there are now seven collared females in this population. Six of those seven females bore lambs in 2002, one of which died shortly after birth, which yields a surviving lamb:adult ewe ratio of 71:100 coming into winter. Adding other adult females that were recorded with those collared females during these samplings yields totals of 11 lambs for 15 adult females, or a ratio of 73:100. While this sampling is somewhat limited, it suggests that lamb:ewe ratios continue to run around 75:100, a level that has been recorded every year beginning in 1999. Apparently, rising population density is not yet having a negative effect on reproductive output.

In the absence of good census data, one can only project a probable population size based on past data. It is likely that the Wheeler Ridge herd contained 60-65 sheep at least a year of age during the 2001-02 winter and a total of 80-90 with lambs. Similarly, it is likely that the herd size broke 100 with the addition of lambs this past summer. A future year of good census opportunities should allow refinement of these figures through reconstructed populations. Until such a count occurs, a current round estimate of 100 is reasonable and conservative.

VI. Mount Gibbs Herd Unit

It has been possible to track the female component of this deme in complete detail, in part due to its small size. In 2001, it contained 2 adult females, 1 yearling female, and 1 lamb. Six adult males were known in addition. This year there were 3 adult females, 1 lamb (probably female), and 1 yearling male. In addition, 4 adult males were seen multiple times. If this year's lamb survives to become an adult, the reproductive base of the herd unit will probably grow to 4 females. While that number sounds precariously low, it is a major increase from the single female that was the reproductive base during 1993-1997.

VII. Mount Warren Herd Unit

Tioga Crest Deme

Similar to the Mount Gibbs herd, it has been possible to track this little group of females over time. In 2001 it contained 2 adult females, 2 lambs, 1 yearling male, and 1 2-year old male. This year it contained 2 adult females, 2 yearling females, and 1 2-year old male in early July. Thus, the reproductive base doubled between years, which is the highest it has been since 1995.

Mount Warren Deme

Despite its small size, this group of females has been very difficult to track since 1998. In 2001, 3 females and 2 lambs were observed. In late July this year, Les Chow of USGS BRD

observed 7 sheep north of Mount Warren which were classified as 3 females, 2 yearlings, and 2 lambs. In early October, a group appeared on Tioga Crest at Dore Pass which, by its composition, had to include the Mount Warren sheep. This group was classified at close range as 4 adult females, 1 yearling female, and 3 lambs (all female). Because this group contained 1 more lamb, 1 more female, and 1 yearling fewer than the group reported on Mount Warren, it is difficult to reconcile those two observations. Since the October group was observed on Tioga Crest, it might have mingled with the female group there and exchanged some members. Minimally, an additional lamb existed than was reported for Mount Warren in July. Fecal samples will be used to try to sort this out by genotypes. Regardless, it appears that the Mount Warren herd unit now contains at least 8 females, including yearlings, and may gain 3 more if this year's lambs survive to adulthood.

In addition to female groups, 7 adult males were sighted on multiple occasions during summer in the area of "Lamb-Ewe Basin" south of Mount Warren. They also were present in the Lee Vining Canyon winter range during spring, where two of them were caught and collared. The combined Mono Basin herds currently are known to contain at least 11 females, including yearlings, 13 males, and 4 lambs (probably all female), for a total of 28 sheep. There may be some additional males, and possibly another female.

Population Total

In 2001 a conservative total population of sheep in the Sierra Nevada was 250. To this can be added the 11 sheep seen at Charlotte Dome (including 2002 lambs) that are sheep previously unaccounted for, as well as at least 5 more females in the Sawmill Canyon herd now known from genotypes. Additional lambs produced in 2002 in the Mount Baxter, Mount Williamson, and Mount Langley herd units totaled about 30, and additional lambs undoubtedly will be documented for the Sawmill Canyon herd. Lambs in the Wheeler Ridge and the Mono Basin herds will almost certainly bring the 2002 lamb total to more than 50. All evidence suggests that adult survivorship again has been high this past year. Consequently, it is very probable that reconstructed population sizes for 2002 developed in future years will put the total sheep numbers in the Sierra Nevada above 300, including 2002 lambs.

This figure can be developed independently. In this report I put forth likely round, but conservative, total herd sizes for all herd units except Mount Baxter and Sawmill Canyon that summed to about 210. The number of adult and yearling females in the Mount Baxter and Sawmill Canyon herd units can be projected conservatively to be 45. Even if the males in those herd units totaled only 30 (67 males; 100 females), adding 15 lambs from this year (assumes only 4 at Sawmill Canyon and Charlotte Dome combined) brings the total in these two herd units to 90 and the Sierra Nevada total to 300. Given the conservative nature of these projections, the actual total can be expected to exceed 300. Thus, for 2002, 300 is a reasonable and conservative round figure to use. While continued population increase is a very positive sign, range expansion through translocations to additional herd units remains a major conservation challenge for these sheep.