THIRD QUARTER REPORT OF THE SIERRA NEVADA BIGHORN SHEEP RECOVERY PROGRAM

Photo by Mark Kiner

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SIERRA NEVADA BIGHORN SHEEP RECOVERY PROGRAM
CALIFORNIA DEPARTMENT OF FISH AND GAME

RANGE EXPANSION OF THE WHEELER RIDGE HERD

The Wheeler Ridge herd unit contains nearly 1/3 of all Sierra Nevada bighorn sheep. Wheeler Ridge provides excellent low elevation winter range but the summer range lacks abundant meadows and is limited to dry subalpine and alpine habitats. Adjacent areas within the herd unit offer optimal summer range in the form of verdant alpine meadows including hanging meadows that occur within bighorn escape terrain. During summer 2008, bighorn ewes wearing GPS collars revealed evidence of recent range expansions into such optimal summer range meadow habitat (Photo 1). While bighorn in recent years have exhibited strong philopatric behavior (i.e. they are prone to remaining in an established home range), the recent movements by ewes to the southwest in the direction of Merriam and Royce Peaks indicates strong potential for herd expansion (Figure 1).

Photo 1: Granite Park, Wheeler Ridge herd unit. An example of alpine meadow habitat and hanging meadows in escape terrain used by bighorn sheep.

Colonization of adjacent range is essential for reducing competition for forage among animals in an enlarging population. As a population grows without expanding its range, density dependent effects on reproduction and survival will ultimately limit the capacity of the population to grow further. Historically, bighorn sheep populations in the Sierra Nevada occupied areas similar to those seen in this range expansion. The reestablishment of likely historical migration routes is an anticipated benefit of growing populations. Because bighorn sheep are highly philopatric, the pattern of expansion is hypothesized to be one where occupied portions of the range experience increases in density until a few animals finally explore adjacent areas and establish new home ranges. In the Sierra Nevada, there is an abundance of habitat for bighorn sheep to expand into and such expansions are desirable if bighorn are to reach numerical and geographic recovery goals.

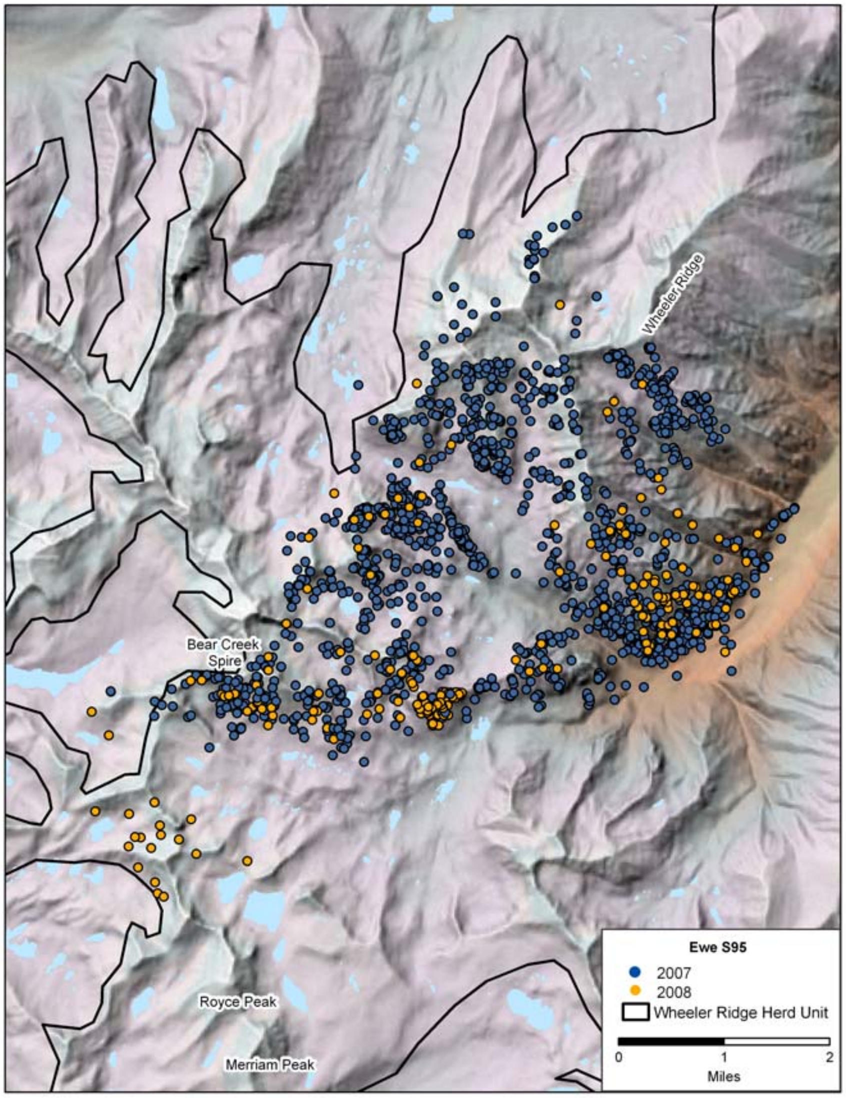


Figure 1: Locations of a Wheeler Ridge bighorn ewe that expanded her range during 2007 and 2008.

The Use of Yosemite National Park by Sierra Nevada Bighorn Sheep

It is well established that native bighorn sheep inhabited the crest of the Sierra Nevada near the eastern boundary of Yosemite National Park. Although John Muir spent considerable time in the Yosemite area in the late 1800s and early 20th century, he never recorded seeing bighorn sheep, but did note that three were killed around 1870 in Bloody Canyon east of the crest. In 1898 he wrote “Few wild sheep, I fear, are left hereabouts”. Concrete evidence of their existence in the Yosemite region comes mostly from skulls collected and deposited in various museums.

In the late 1970’s the Yosemite region was surveyed extensively to assess where suitable habitat might exist, and that effort lead to the conclusion that Lee Vining Canyon east of the park was the most appropriate location for a first attempt to re-establish bighorn in that region. Lee Vining Canyon provides suitable low elevation winter range in proximity to the high elevation range that Yosemite provides. Bighorn were moved to Lee Vining Canyon in 1986 and 1988 to establish such a population.

Following the first bighorn release in Lee Vining Canyon, one translocated ram wandered deep into the Park during his first summer before returning to the Mount Warren region. Otherwise it has taken range expansions for the Mount Warren population to use Yosemite. The first expansion occurred immediately in the summer of 1986, when 3 females accompanied by 2 lambs born in Lee Vining Canyon moved south to Mount Gibbs. This small herd barely survived a period of no reproduction due to the absence of rams, but now has a reproductive base of 7 females. Both males and females in the Mount Gibbs herd cross the boundary into Yosemite, but rams are the primary users in the Kuna Crest area, as the map of GPS collar locations shows (Figure 2).

In 1998 as the population experienced a decline, females using Lee Vining Canyon abandoned use of that lower elevation winter range and expanded their range north to Lundy Canyon. Excelsior Peak became an important part of their new range, where they cross in Yosemite Park regularly. In 2006, a newborn lamb was documented on Excelsior Peak within the Yosemite boundary. Bighorn were also documented in recent years to move into the Park along Shepherds Crest. Skull records suggest that bighorn use of Yosemite was once more extensive. It will take larger herd sizes and time for all suitable habitat within the Park to become part of the range of the current big-horn herds in this region.

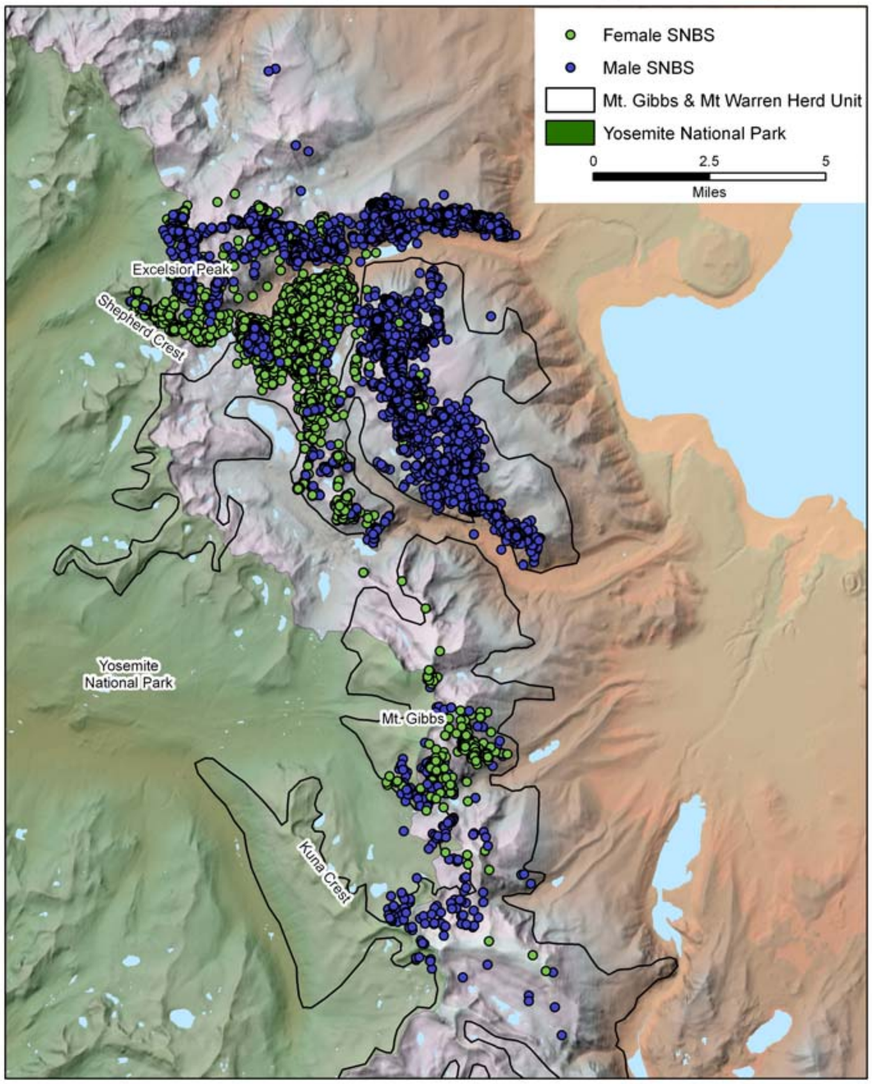


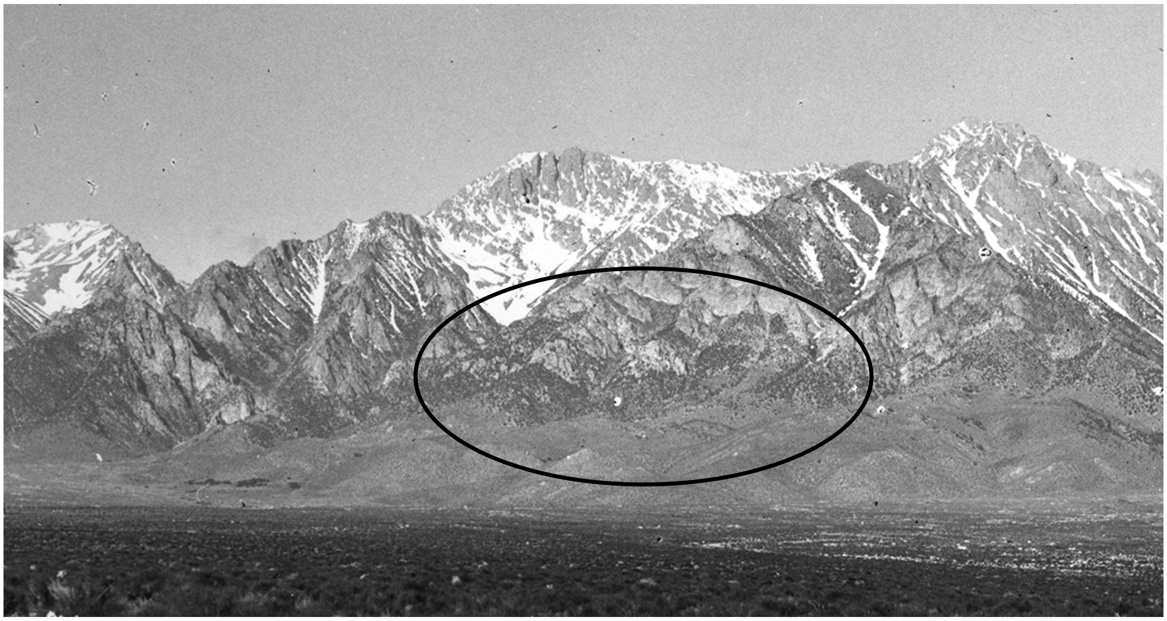
Figure 2: Bighorn use of Yosemite National Park and adjacent lands.

Using Repeat Photography to Detect Vegetation Change

One of the limiting factors identified in the SNBS recovery plan is the loss of open habitat. Open habitat is important for bighorn sheep because it has higher forage biomass and increased visibility, which allows bighorn to detect predators. Open habitat in lower elevation ranges has been declining due to encroachment of pinyon (*Pinus monophylla*) forest. This project quantifies the amount of open habitat that has been lost by comparing historic and current images. Large portions of historic habitat are covered with air photos which date back to 1929 and 1944. In addition, historic ground photos from 1880 to 1910 will be retaken and analyzed for changes in forest cover. Ground photos have limited coverage but are the only quantifiable sources of information from that time period. We will employ a series of change detection and repeat photography methods designed to quantify the changing patterns of pinyon forests captured in the photographic record. Determining historic habitat conditions will provide direction for future habitat management.

Repeat photography does not involve just taking a picture that is similar to the original; the goal is to take an exact replica. This means the camera, more specifically the focal point, is in the same x, y, z position as the original camera and that the camera is rotated about the axis in the same manner. This is integral to this study as a change in perspective can greatly change what is seen in a photograph and for comparisons and measurements between historic and present day photographs to be meaningful the perspectives must match. To fine tune this process when getting close to the correct point, measurements in the photos are made between five or more prominent features distributed throughout the scene. Using the principles of parallax and collinearity these measurements are analyzed and the camera is moved appropriately before taking the final photo. Following acquisition of ground and aerial photos, they must be orthorectified before any analysis can occur. In other words, a landscape feature in a photo will be given the exact x, y, z coordinates that it occupies in the real world. Two-dimensional photos are converted to 3-dimensions that may be analyzed in a geographic information system (GIS). Once in a GIS, the features in the images such as pinyon forest will be digitized as polygons that may be compared among the various time periods. We will explore questions such as the extent to which forest has expanded down-slope to cover more area or has increased in density.

While the images have not been completely processed, substantial changes in pinyon density are already evident (Photos 2a and 2b). The results of this project will be used to influence management recommendations regarding the use of prescribed fire to open forested landscapes. In addition, we will estimate whether vegetation change has altered the carrying capacity for bighorn sheep in the recovery area.



Reed Collection, Special Collections, Honnold/Mudd Library, Claremont University Consortium

Photos 2a and 2b. Top: The slopes of the eastern Sierra Nevada photographed between 1895 and 1914 with Mt. Keith on the upper right. Note the sparse pinyon forest identified by the ellipse. Bottom: The same location photographed in 2008 with much denser forest.

Desert Sheep Database Development

Data sets spanning more than 40 years have been accumulated during the management of desert bighorn sheep in California. Currently, we have a project underway to integrate the various departmental and regional data sets into a single, integrated database management system (DBMS). This system will facilitate more effective adaptive management of these animals from both hunting and conservation perspectives. Available data sets to be included are: capture, survival, locations (aerial telemetry, ground observations, and GPS collars), harvest, and population surveys. The database will be menu driven and available state-wide through the DFG network. Convenient input forms mirroring data recording forms will be included. The database will provide a host of standard reports as well as ad-hoc reporting capabilities. Direct data output to tools such as ArcGIS and Program Mark will allow biologists and managers to more efficiently analyze and utilize data sets on a routine basis.

The primary intent is to provide user-friendly electronic data access for both legacy data and new data sets. This will allow a diverse group of geographically disparate users to maintain, access, and view biological data sets as part of data-driven decision making. An added benefit is to allow for efficient use of complex data resources in an analytic context in support of both reporting and actionable management objectives.

Birth Site Identification Using Cluster Analysis

Understanding the population dynamics of mule deer whose winter range is sympatric with that of the Sierra Nevada bighorn sheep is critical for the recovery of the endangered bighorn. Mule deer in Round Valley provide the main prey base for mountain lions. Therefore, lion numbers are largely associated with population fluctuations of the mule deer. Large mule deer populations, such as the one in Round Valley, support lion populations adjacent to bighorn herd units like Wheeler Ridge. During the past 3 years, the Round Valley deer project has worked intensively to understand patterns of recruitment of fawns on summer range. Approximately half of the Round Valley deer spend summers on the west side of the Sierra crest, whereas the remaining spend summers on the east side of the Sierra crest. In recent years, recruitment of fawns by west-side females has been less than half of that exhibited by east-side females. One investigation has focused on determining cause-specific mortality of neonates on both sides of the crest and the associated costs of reproduction incurred by females.

In order to identify birth sites, we are developing a new technique using fine-scale movement data acquired with the use of GPS collars on pregnant females (Figure 3). Large ungulates typically exhibit a restriction in movement as timing of parturition nears. Other scientists have utilized GPS data to coarsely identify the area where birth occurred. This approach has not been validated with field data. Using vaginal implants, we identified birth sites and captured the neonate(s) to help validate our birth site identification technique. Besides successfully capturing and collaring 43 neonatal mule deer during the summer of 2008, we successfully identified birth sites from 12 females that had been fitted with GPS collars the previous March. In March we fitted 4 females with GPS collars that were not pregnant to represent a control in movement patterns because they should not exhibit patterns of movement associated with parturition.

Currently we are working to establish the appropriate technique to identify timing and location of birth. Assuming that we are able to use patterns of movement to identify birth sites for mule deer, a similar approach may be utilized to characterize critical lambing habitat for Sierra Nevada bighorn sheep. Identifying birth sites and timing of birth for mountain sheep is often impossible from the ground because of the rugged terrain where lambing occurs. The capability to identify timing and location of parturition using GPS data will improve our understanding of habitat critical to the recovery of Sierra Nevada bighorn.

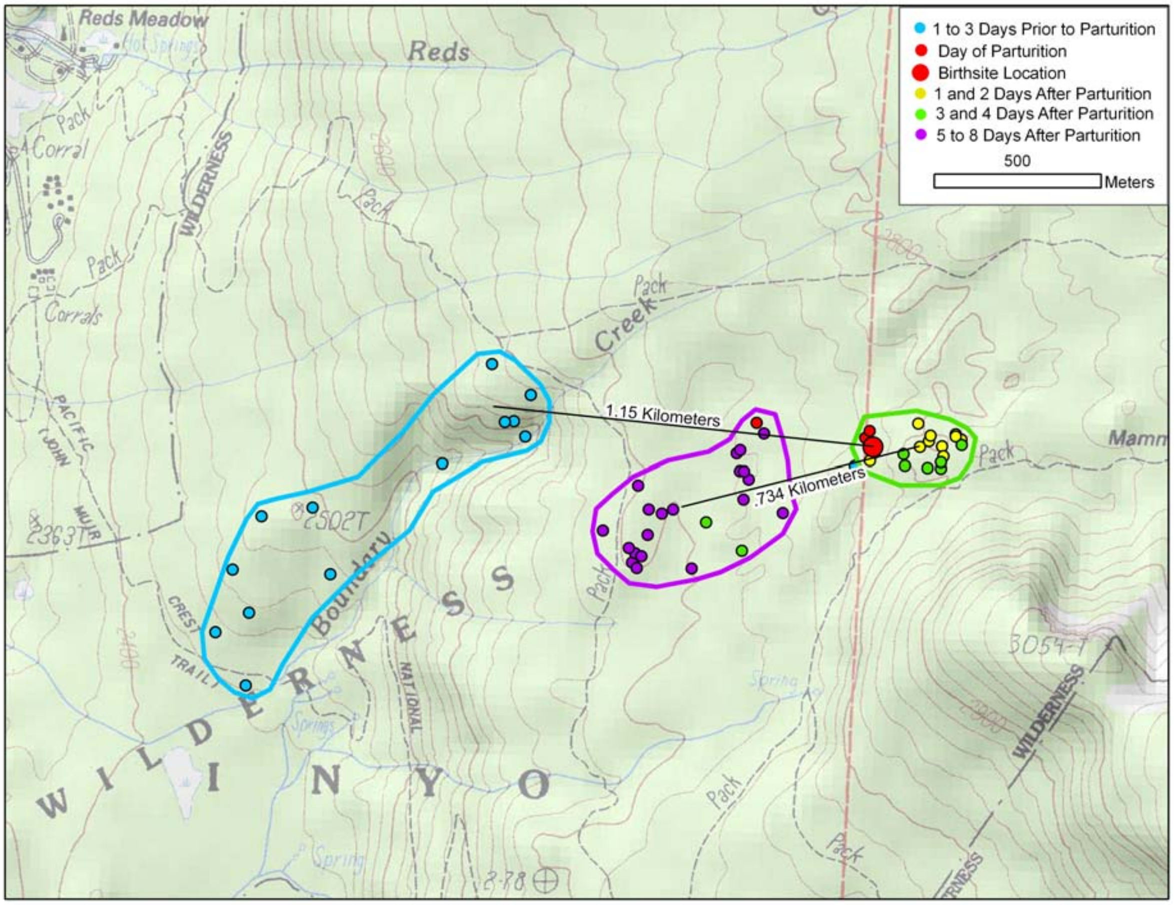


Figure 3: Locations of a mule deer doe before, during, and after parturition during June-July 2008. The proximity of the locations may be used to identify the birth site because the female restricts her movements around the birthing period.

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