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THE BEAR MOUNTAIN BIGHORN SHEEP TRANSPLANT RESEARCH PROJECT: A PROGRESS REPORT

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Abstract: The precipitous decline of Rocky Mountain bighorn sheep (Ovis canadensis canadensis) in North America, beginning in the late 1800's and continuing on into the mid-1900's, included the devastation of populations in Utah, leaving fewer than 100 at the lowest point. The Utah Division of Wildlife Resources began to reintroduce bighorn to former ranges in 1966. After 2 reintroduction attempts had failed, intensive research was initiated to help biologists more effectively manage future transplants. This report describes all phases of research related to the transplant of bighorn sheep on Bear Mountain.

Beginning in the late 1800's and continuing until the first decades of the century, numbers of Rocky Mountain bighorn sheep declined rapidly in the United States (Thorne et al. 1984). In the state of Utah, all but 1 native herd, numbering fewer than 100, had been extirpated by the 1950's (John 1975). John (1975) speculated that the 2 major causes for the decline were intensive grazing by domestic livestock with associated habitat deterioration, and over-hunting. Recent reports (Goodson 1982) suggest that diseases contracted from domestic sheep may have played a major role in precipitating bighorn die-offs as well.

In response to the near extirpation of all Rocky Mountain bighorn sheep populations in the state, the Utah Division of Wildlife Resources (UDWR) initiated its first bighorn sheep transplant in 1966 near Brigham City. (For a history, status and distribution of bighorn in Utah see Smith et al. 1988). These bighorn sheep, as well as those involved in the second transplant attempt were confined in an enclosed paddock before release into the surrounding area. Within 9 years the first transplant attempt had completely failed (J. Pederson, biologist, UDWR, pers. comm.). Within 4 years a second release, known as the Mount Nebo transplant, had failed as well (P. Tervort, biologist, UDWR, pers. comm.).

The UDWR laid plans in the late 1970's and early 1980's for a third attempt at reintroduction. Subsequent investigations indicated that the rugged Green River Corridor of northeastern Utah not only historically supported Rocky Mountain bighorn sheep but should again, if a release was made. Bear Mountain of the Flaming Gorge National Recreation Area was

selected as the release site, because the area was remote, rugged, and isolated from domestic sheep allotments.

In January 1983, 19 sheep from Whiskey Mountain, Wyoming were released onto Bear Mountain. A second release of 17 sheep, also obtained from Whiskey Mountain, occurred in January 1984. Differing from the state's first 2 transplant efforts, the Bear Mountain sheep were released directly onto the mountain with no attempts to hold them for a time in an enclosure.

By the spring of 1985, when it became evident that the Mount Nebo transplant was failing, UDWR personnel concluded that intensive bighorn research would be invaluable in helping secure the success of future transplants. With a new and promising herd recently established on Bear Mountain, UDWR initiated the Bear Mountain research project.

THE BEAR MOUNTAIN BIGHORN STUDY

In the spring of 1986, a cooperative study involving the Utah Division of Wildlife Resources, Brigham Young University (BYU), the U. S. Forest Service (USFS), and the U. S. Bureau of Land Management (BLM) began and continues to date. Major emphasis was placed on population dynamics, disease-parasitism, inter-specific competition, and habitat selection. The primary research objectives include the following:

1. Estimation of population dynamics (natality, mortality, survivorship, and recruitment of the introduced herd of bighorns.

2. Determining and monitoring levels of internal parasites, as well as other disease factors.

3. Obtaining measurements of forage preferences, level of use, and seasonal diets.

4. Estimation and quantification of critical habitat parameters.

5. Monitoring bighorn movements, thereby determining home ranges and dispersion.

6. Identifying potential competitors such as mule deer (Odocoelius hemionus), elk (Cervus elaphus) and pronghorn antelope (Antelocapra americana) as well as monitoring predator populations and impacts.

7. Determining the nutritional quality of the occupied rangelands, as inferred by suckling and play behavior of lambs.

8. Evaluation of past prescriptive habitat improvements as well as identifying, implementing, and evaluating additional improvements.

STUDY AREA

Bear Mountain, within the Flaming Gorge National Recreation Area, is a high plateau (2200 m) bounded by precipitous cliffs, plunging 420 m to the Flaming Gorge reservoir below. The rim of the plateau is

characterized by a ponderosa pine-mountain brush complex, while the interior is an open sage-grass community. The steeper slopes and cliffs support varying densities of pinyon-juniper cover. Several wild and prescribed burns have reverted dense pinyon-juiper areas to highly productive forb-grass meadows. Water is limited on top to ponding of snow melt in spring and several man- made guzzlers. A few small seeps and springs in the cliffs provide water in critical lambing areas.

Observations of bighorn sheep, petroglyphs and skeletal remains indicated that the area historically supported bighorn sheep which disappeared around the turn of the century. Pronghorn antelope, mule deer, elk, mountain lion (Felis concolor), bobcat (Felis rufus), and numerous smaller mammals also inhabit the mountain.

METHODS

In order to achieve the research objectives the following methods were utilized.

1. Population dynamics are monitored through frequent observations of the herd. Twenty-three radio-collared individuals, or 33% of all animals (70), allows accurate location of the herd. All radios have a mortality mode, facilitating the swift recover of dead sheep. Also, 10 of the 1987 lamb crop were radio-collared to allow close observation of this high-risk age class.

2. Internal parasites and diseases are observed by 3 approaches. First, levels of parasitic lungworm (Protostrongylus spp.) present in the herd are monitored using the standard Baermann technique. Samples are collected only from known, marked animals (24). Fecal analysis is performed by the Veterinary Research Laboratory at Montana State University. Concurrently, 3 anthelminthic drug applications (Panacur, Ivomec, and Zimecterin) have been given to 9 test animals (3 of each trail). Fecal analyses reflect the relative efficacy and longevity of these drugs in repressing lungworm levels.

   Second, blood physiologic values are commonly used as diagnostic tools for identifying diseases and measuring stress (Bunch et al. 1980). The UDWR, in conjunction with the Bighorn Research Institute of Palm Desert, California, and with assistance from BYU students and personnel, captured, via drop-net, a total of 15 sheep of the Bear Mountain herd in January 1988. Blood was drawn, nasal and throat swabs taken, and fecal samples collected. Procedures are described by Bagley and Buch (1980).

   Third, mortality sensor transmitters on 23 animals allow quick detection of deaths, thus aiding cause-of-death determination. Recovered mortalities are either field-examined or taken to a veterinarian for necropsy.

3. Forag preferences are being identified by direct observation, feeding site analysis, and by fecal analysis. Direct observation of foraging bighorn and a subsequent, detailed on-site analysis allows determination of plant species utilized and their degree of use.

Percent cover of each species present is estimated. Meter square plots are positioned on a grid, and all species clipped and weighed for a measure of above ground biomass. Fecal pellets are collected from known individuals representing all age/sex classes. These will be subjected to a microhistological technique for determination of percent composition of the various species present in the diet.

4. Transmitter-equipped bighorn locations are quantified as to critical habitat parameters. At each site: distances to cliffs, to cover, to habitat edge, to water and mineral licks are recorded. Additionally, horizontal visual obstruction is measured using a meter square, gridded target. Preferred habitat is, thus, described quantitatively.

5. Bighorn movements and home ranges are determined by radio-telemetry. Several times weekly, sheep are found and locations recorded on reduced 7.5 minute topographic maps. The computer program TELEM (Coleman and Jones 1986) is employed to generate information on home range size, distance moved per unit time, and activity centers for specific animals.

6. Assessment of potential habitat competitors is ongoing. During the year, numbers and distribution of deer, elk, and pronghorn antelope are recorded. Predator populations have been censused during winter via track counts and visual observations. All predator feces are collected and analyzed for bighorn remains.

7. Shackleton (1973) reported that nursing and play behavior in bighorn lambs quantitatively reflected the nutritional quality of the occupied rangelands. From May 25th through the end of July, observation of nursing behavior is conducted. Using a spotting scope and stopwatch, lambs and mothers are observed with particular attention paid to: initiator and terminator of nursing bouts, length of bout, number of bunts, and lamb play behavior.

8. The UDWR and USFS have implemented several habitat improvements including, guzzler construction, spring and seep developments, and prescribed burns to expand bighorn ranges. Documentation of water developments has been done opportunistically and by motion-sensitive cameras. Bighorn range expansion into burns is documented by means of telemetry-tracking and subsequent observation.

RESULTS

To date, comprehensive data analyses have not been conducted. They are to commence in fall of 1988. A brief summary follows of some preliminary results of research conducted to date.

1. Constant monitoring of the population over the past 2 years has indicated the following: reproduction is high (83% of all mature ewes bore young in 1986, 77% in 1987), survival of lambs to yearling age is moderate (50% in both years), and mortality for adults is low (less than 5% both years) due to the population being relatively young. The dense pinyon-juniper forests surrounding Bear Mountain not only block

emigration from the next nearest herd (48 km), but immigration as well.

2. A year of monitoring lungworms indicated that all animals (excepting newborns) have tested positive for lungworm, even though the entire herd was treated with anthelminthic drugs (ivermectin) before being released. Lungworm levels range from a high of 656 to a low of 0.4 larvae per gram of dry feces. Of the 3 anthelminthic drugs tested, none had long lasting effects, with most sheep showing reinfection within 2 months of treatment. Research has also revealed that lungworm larval output appears cyclic (high-low-high), with the cycle repeating approximately every 2.5 months. All pregnant ewes exhibited a peak in output just prior to parturition. Blood profiles are pending.

3. Dietary data are forthcoming and unavailable for comment. However, lambing habitat appears to be an area of concern. In the steep lambing areas, highly preferred forages show signs of over-utilization. If trends continue, preferred vegetation will be eliminated from these ranges. Permanent transects are being installed to detect trends in range quality.

4. Bear Mountain bighorn rarely range more than 250 meters from escape cover, nor do they enter areas where visibility is limited. During lambing, ewes choose areas with slopes exceeding 70%, whereas rams choose relatively level areas year-round.

5. Thousands of observations of bighorn sheep locations will provide accurate home range, herd expansion, and individual movement information. However, these data are yet to be analyzed and unavailable for comment.

6. Deer, elk and pronghorn antelope are seasonal occupants of Bear Mountain and do not compete with bighorns for forage and functional cover. Coyotes are occasionally found in the area but are not considered to have negative effects on this herd. Mountain lions may be a problem, but more research is needed to clarify their relationship with this herd.

7. Nursing and play behavior were closely monitored in summer of 1987. Over 300 nursing bouts in 200 hr of observation were recorded. Although precise data analysis is forthcoming, it was apparent that the age of a lamb has a great influence on nursing frequency. For example, on June 11th a 2-day old lamb was observed continuously for 11 hours. It nursed 38 times. Five days later (June 17th), this lamb nursed only 14 times, or 63% less, during a comparable time period. A sharp reduction in nursing frequency was also noted in other lambs, particularly newborns. Therefore it appears that in very young lambs suckling frequency is affected by age to a high degree. Other studies (Shackleton 1973) have shown differences in suckling lamb behavior patterns between "high" and "low" quality ranges. Lamb ages were either unknown or at least unreported. Therefore, inferences between "high" and "low" quality range comparisons based on lamb suckling

behavior may be biased or influenced by lamb age differences between sites or observations.

8. Evaluation of bighorn response to guzzlers suggests that bighorn avoid watering from them. This has also been reported by R. L. Schmidt (biologist, Colorado Division of Wildlife, pers. comm.). Development of catchments at springs have received immediate use by bighorns. In autumn 1985, 200 ha of dense pinyon-juniper, adjacent to bighorn ranges, were burned by the USFS heli-torch and reseeded for bighorn. The following year sheep moved into the area and fed heavily on the lush growth of grasses and forbs. In 1986, reseeded vegetation covered 23% of the bare soil. In 1987, reseeded vegetation provided nearly 50% ground cover. A problem was encountered, however, as the fire activated mustard seeds (Descurainia pinnata and Sisymbrium altissimum) dormant in the soil. These mustards grew into dense, 2 m high thickets which blanketed the entire burn, thereby reducing horizontal vision considerably (100% obstruction of vision at 7 m in all directions). Consequently, no bighorn sheep use was documented of this area in 1987. It is anticipated that this mustard will not persist and bighorns will move back into the area. Research data will be analyzed using the PATREC (Williams et al. 1977) habitat evaluation procedure. The PATREC model utilizes statistical inference for defining habitat evaluations, organizing existing knowledge about wildlife habitats and species' requirements in a quantifiable manner, and are flexible enough to use with a wide range of species. PATREC models are already developed for many species, including bighorn sheep (Holl 1982). The goal of PATREC model is to evaluate transplant sites for future releases within the state. It will also provide managers with another tool for improving habitat within existing bighorn population ranges.

DISCUSSION

Geist (1978) theorized that to maximize efficiency in bighorn management, knowledge of local populations is needed. Olsen (1986) reiterated the need for better monitoring of releases to determine movements and permanent herd establishment. Though in a broad sense, bighorn behavior and habitat requirements are becoming more clearly understood, regional environmental differences may present unique situations which demand varying responses from bighorn and game managers alike. The Bear Mountain research project is providing specific information for UDWR and USFS biologists that they may more effectively manage this, and other, bighorn herds in Utah.

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