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THE USE OF TRANSPLANTING TO EXPAND BIGHORN SHEEP RANGE

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Abstract: In March 1977, 20 bighorn sheep (Ovis canadensis canadensis) were transplanted from a migratory herd in the Tarryall Canyon near Pikes Peak to the east side of Rocky Mountain National Park, Colorado. The objectives of the project were to expand the winter range of the native sheep population from primarily alpine tundra ranges to historically used low elevation sites that had been abandoned, and to re-establish historic annual migration between the two range areas. In 1982, since it was believed the introduced sheep had established their movement patterns, a study was initiated using radio telemetry to document the movements and range use of these sheep. Observations from 1982 to 1985 indicate that the introduced sheep do winter primarily on relatively low elevation ponderosa pine (Pinus ponderosa)/shrub sites along Fall River, Black Canyon and Cow Creek (the release site). Annual movements from these areas were made generally in July to the alpine tundra summer range areas in the vicinity of Mummy Mountain. The adult males summered separately from the ewes and lambs, generally on alpine range in the Desolation Peaks. Return to the winter range was made in September or October. Since the objectives were met, the project was considered a success.

INTRODUCTION

Transplanting of bighorn sheep has become a popular method for extending sheep distribution (Bear 1976, Kopec 1982). However, few studies have been made of transplanted populations after they have stabilized their range use patterns.

A bighorn sheep transplant to abandoned historic range areas was included as part of the 1976 Management Plan for bighorn in Rocky Mountain National Park (Stevens 1982). This plan was initiated in response to studies showing that the native sheep population wintered primarily on quite restricted areas on the alpine tundra (Baumann 1978), and that no use was being made by sheep of most of the low elevation historic winter range (Contor 1958). Sheep populations on restricted ranges may be vulnerable to severe mortality as a result of stress, pneumonia complex or lungworm infections (Post 1976) and be rapidly decimated (Moser 1962, Thorne 1971, and Simmons 1982). A transplant was proposed to alleviate this situation. In cooperation with the Colorado Division of Wildlife 20 bighorn sheep were transferred from the Pike's Peak Area to the east side of Rocky Mountain National Park.

The objectives of the reintroduction were to expand the range used by restoring bighorn sheep to historic low elevation winter ranges and to redevelop migration routes between alpine tundra summer range and low elevation wintering areas.

Initial observations on the sheep indicated that they had established patterns of movement and range use by 1981.

A study utilizing radio telemetry was initiated in 1982 to test the hypothesis that the objectives of the transplant had been achieved.

STUDY AREA

The study area was in the northeast section of Rocky Mountain National Park east of the Continental Divide. It covered an area of about 30,000 hectares, including the Mummy Range of mountains (Figure 1). Elevations ranged from 2329 meters to 4133 meters.

The mountains were formed by precambrian metamorphic schists and gneiss intruded by large masses of granite and pegmatite (Richmond 1974). Present physiography demonstrated the extent of alteration by pleistocene glaciation. The soils were relatively infertile and low in essential elements, being very sandy with poor development from decomposed granitic substrates.

The climate was typical of the central Rocky Mountains. At lower elevations, annual precipitation was 41 cm, with a mean annual temperature of 6°C. Precipitation increases with elevation to as much as 66 cm on the alpine tundra, while mean temperatures decrease. Highest precipitation occured in late March and April, with heavy wet snows. In winter, the precipitation fell as snow, but severe winds blew many areas free and deposited the snow in drifts, especially in the alpine.

Vegetation of the study area represented three climax regions (Marr 1961), all of which are utilized by bighorn sheep. The upper montane climax region occurred from 2300 to 2740 m elevation. Dominant vegetation types were the ponderosa pine (Pinus ponderosa)/shrub savannah, closed canopy Douglas fir (Pseudotsuga menziesii)/ponderosa pine forest, and a lodgepole pine (Pinus contorta) forest. Interspersed in the bottom areas and more mesic sites were grassland, meadow, and willow (Salix spp.) types. Aspen (Populus tremuloides) was present in small standa. Above the montane, from 2740 to 3500 m, was the subalpine forest region. It was characterized by an Engelmann spruce/subalpine fir forest, interspersed with lodgepole pine and limber pine (Pinus flexilis) stands. In the openings were willow and herbaceous meadow types. Above the forest at about 3500 m was the alpine tundra. Vegetation of the alpine was a complex mosaic of types related to numerous environmental factors, interspersed with rock outcrops and talus slopes (Willard 1979).

Ungulates that shared the park ranges with bighorn sheep were elk (Cervus elaphus nelsoni) and mule deer (Odocoileus hemionus). The elk, a dominant ungulate in the park, with a population of over 3,000, utilized most of the vegetation types in the summer. Although most moved to the upper montane in winter, some remained on the alpine tundra. About 200-300 deer, a portion of a much larger summering population, remained in the park to winter.

HISTORY OF SHEEP POPULATION

Bighorn sheep were very common in the vicinity of Estes Park when the first settlers arrived. However, when the National Park was established in 1915 the population had declined to an estimate of 1,000 (Packard 1946). After a brief recovery the decline in numbers continued and in 1935 Potts estimated only 192 sheep left in the park. An intensive study covering more of the park was initiated by Packard in 1939. His total count was 318. Packard still found sheep on low elevation ranges on McGregor Mountain, Cow Creek, Black Canyon and Castle Mountain. By 1958 when Contor made his count, the sheep had abandoned the use of these areas except for possibly a few on

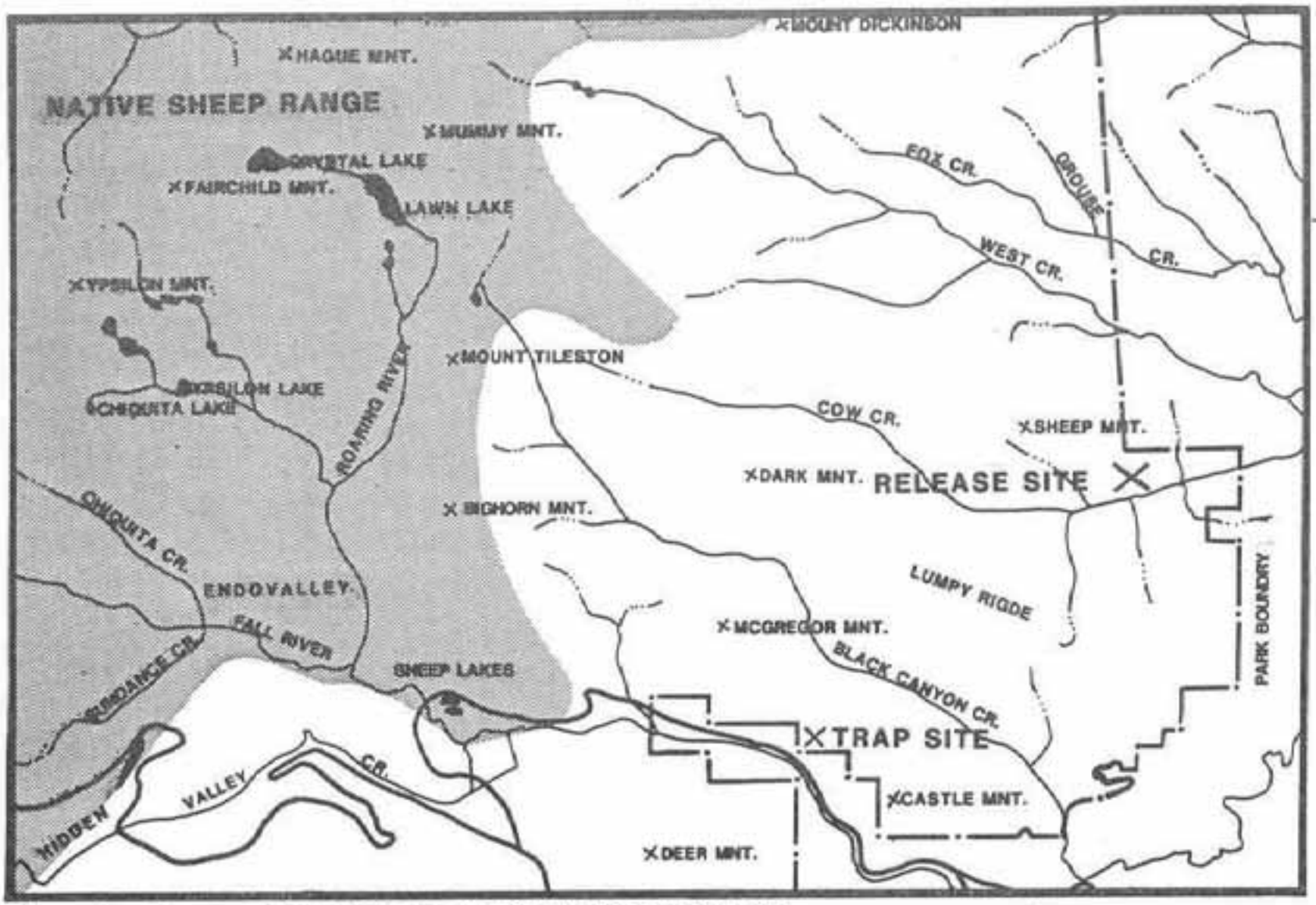

Figure 1. Range used by native sheep prior to 1977 transplant.

Cow Creek. He estimated the total population to be only 36 sheep in the total Mummy Range area. This was probably the low point for the population. If this count was correct by the time Goodson (1978) did her study, the population had increased in the intervening years to an estimated 81 sheep.

Reasons for decline in the population have been hypothesized by numerous investigators. In the early days the first decline was probably the result of market hunting, livestock competition for forage and scabies introduced by domestic sheep. Later, although range competition with livestock was still important, competition with increasing elk and deer populations was becoming a factor. Also the presence of lungworm and pnuemonia along with possible mineral deficiencies were considered to be contributing factors.

With the abandonment of the low elevation areas, the Mummy range sheep spent most of the time from late fall to spring on the alpine tundra (Baumann 1978 (Figure 1). Of those observed in the low elevation, most were associated with the natural mineral licks in Horseshoe Park. Although sheep also used south exposures along Upper Fall River above Endovalley, they did not remain on them all winter. Increased use of these areas was made in the spring with the appearance of new green vegetation (Goodson 1978).

Although Goodson (1978) believed the population to be increasing slowly in 1975-76, long term observations indicated a more stagnant situation. Perhaps because of their use of the mineral deficient high elevation range, sheep appeared to nutritionally require the natural licks in Horseshoe Park (Stevens 1982). This demand is believed to cause stress in the native herd due to high visitor use of the area. Also, depending on the alpine for winter range meant a very restricted range availability and the possibility of a major loss as a result of abnormal deep snow conditions, stress or disease. The carrying capacity of these ranges was probably near maximum which would also account for the lack of population increase.

The management solution, supported by the 1976 Master Plan for the park, was to restore bighorn use of the abandoned low elevation ranges.

The most suitable area was on Cow Creek above the McGraw Ranch. An area of 393 acres inside the park had been purchased by the Park Service in 1964 with a 10-year livestock grazing permit that had expired in 1974. After 3 years of rest and the low elk use in that area, the range appeared to be in good condition and available for use.

The transplant was conducted on March 17, 1977. Twenty bighorn were trapped by drop net in Tarryall Canyon near Pikes Peak and released at the park boundary above the McGraw Ranch on Cow Creek (Figure 1). The adult sheep were marked with white neck bands and black numbers while 5 lambs had white ear tags. All released sheep were treated for lungworm infection.

The sheep immediately dispersed. The first observation was made on April 6 when a collared sheep was observed about 4 km east of the release site outside the park headed in an easterly direction. On April 21, five sheep returned to the vicinity of the release site. Further observations on marked sheep were made on the Roaring River Trail and Fall River in May. By October use of the lower Fall River area was common. As also reported by Bear (1976) for other transplants, the movements of the transplanted sheep were extremely variable. In November, the females had attracted 2 males from the native herd for breeding. This was the first record of native sheep on this part of Fall River in recent years.

METHODS

On January 19, 1982 radio collars were placed on 9 sheep at a trap site on Fall River (Figure 1). The sheep were captured by the use of a 21 m square drop net baited with applemash with the assistance of the Colorado Division of Wildlife (Schmidt 1978). A total of 15 sheep were trapped. Three mature females from the original transplant and two yearling females were fixed with radio collars. Two 4-year old and two 2-year old males were also radioed. The remainder of the sheep were just ear tagged with easily readable white tags. All were released at the trap site. In another trapping operation, April 19, 1983 the following year at the same site, the final radio was fixed to a mature female.

The radio telemetry system utilized was the Telonics Model TTR-1 receiver and MK-IV transmitters. The antenna utilized was the RA-2A hand held H-shaped dipole which has excellent direction finding capabilities and is easily back-packable. The transmitters were packaged in a large Model MK-IIIB hermetically sealed enclosure embedded in urethane. They were prepackaged at the factory and attached to a collar of white butyl rubber over cotton webbing. The ribbon antenna was placed inside the collar.

The system operated on frequencies of 164.4375 to 164.6625. Using a B-2A Lithium battery, life expectancy of the transmitter was estimated at 4 years. Each collar weighed from 500 to 650 grams.

Data were recorded both by direct observation and by triangulation of radio signals. Since the terrain was very rugged, signal bounce was a problem, so generally signals from three observation points were required before an observation was recorded.

RESULTS

Of the original 5 females marked, 3 were radio monitored the entire study period. The radio on one of the older transplanted females malfunctioned the first summer. One of the yearlings was killed by a poacher near the release site in 1983. The remaining four females, counting the female marked in 1983, provided most of the information on range use and movement. A total of 238 accurate relocations were made.

In May and June, female groups were generally in the vicinity of lambing areas in the Upper Montane Zone composed of rock outcrops on steep south exposures. The groups consisted of adult females, yearling males and females, and often 2-year old males. Considerable movement between Fall River area, Black Canyon and Cow Creek, a distance of 5.5 km, was observed. Lambing by radio collared sheep occurred on all 3 areas. Following lambing, movements by these groups were rather unpredictable. This was probably related to weather and phenology of vegetation. Movements to the alpine were often made followed by a rapid return to lower elevations and back up again, a distance of about 8 km each way.

Generally by mid-July (mean of July 16) most of the female groups were in the Mummy Mountain summering area (Figure 2). This is an area of 4000 hectares encompassing Mummy Mountain, Mt. Dickinson, Hagues Peak and Fairchild Mountain. The area used is primarily alpine and above 3350 m elevation. About 1/3 of this area is steep cliffs and talus with rock outcrops and tundra

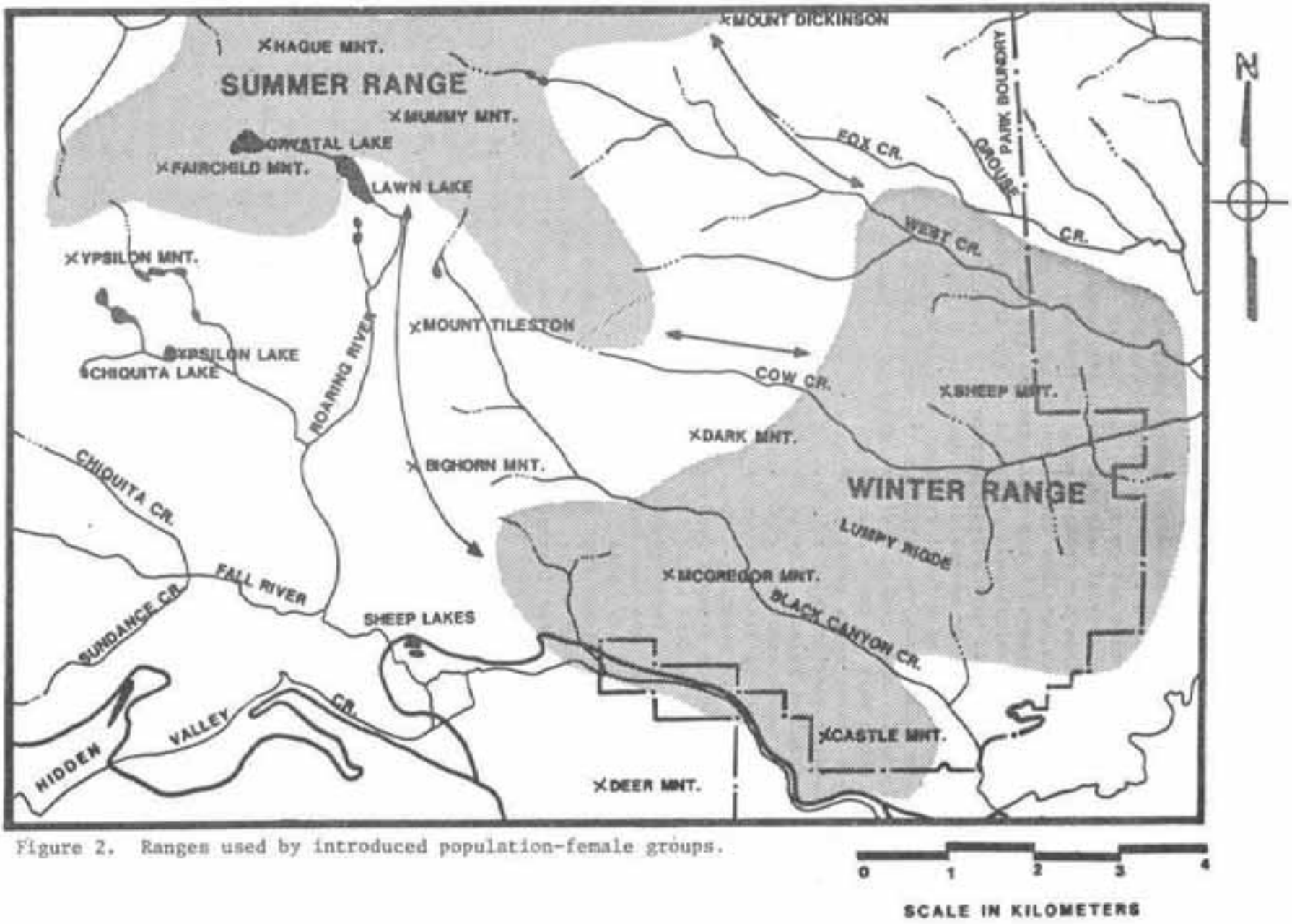

Figure 2. Ranges used by introduced population-female groups.

interspersed. The remainder is fairly gently rolling alpine tundra meadows and fellfields. The sheep utilize the steep rocky areas for escape, resting and feeding, but often move out on to the open tundra to feed. Except for the trail from Lawn Lake to Crystal Lake and the saddle between Fairchild and Hagues Peak, the area does not receive much visitor impact.

This summering area overlaps the summer range used by the native sheep. Some interchange was observed but a separation of the two herds of ewes and lambs did appear to be maintained. Movement of the introduced sheep back to the low elevation is even more erratic probably in response to weather conditions. Early downward movements in August were often followed by a return to summer range and a final movement down in October. In 1984, a relatively late fall, sheep were still on the alpine until late September, while in 1985 early snows caused downward movement in August. The mean for the day that sheep were on the winter range to stay was October 18.

The female winter range consists of an area of 5100 hectares along the east park boundary just north of the Town of Estes Park (Figure 2). It includes the original release site on Cow Creek, McGregor Mountain and Castle Mountain and the south exposures along Fall River east of the park entrance. The rock pinnacles along Black Canyon, Sheep Mountain and the cliff areas just north of West Creek are included. Open ponderosa pine/shrub and grass/shrub vegetation types are the primary feeding areas and are limited to about 600 hectares. However, the more expansive open canopy ponderosa pine and Douglas fir stands also provide a considerable amount of forage.

Although the sheep have been using this winter range for 8 years they continue to pioneer into new areas. The use of Castle Mountain was initiated for the first time in 1983 and West Creek in 1984 as determined by the locations of radio collared sheep. However, a few other areas that were used originally by the sheep after transplant no longer appear to be used by the reintroduced animals. Upper Fall River and the aspen stands along Fall River west of Sheep Lakes were used the first few years. No radio collared sheep used these areas and no other marked sheep have been seen there in recent years. One marked sheep also was observed near Sheep Lakes in 1977 and 1978 with the native sheep. Marked sheep were not observed in this area during the present study.

Since the introduced sheep do utilize the lower elevation ranges it is believed that their mineral requirements are being met by their forage and salt blocks set out by local residents. There is no apparent physiological need to visit the natural mineral licks.

Although four radios were placed on male sheep during the trapping operations, only a total of 56 relocations were made. One of the radios went out in 1982, two in 1983, and one in 1984. As a result, the range use and movement of the rams are not so well documented (Figure 3).

In the spring radio collared males were on Fall River or Cow Creek winter range. During late May and June they did move to higher elevations utilizing the moraine north of Fall River and Upper Fall River enroute a distance at 14 cm for up to two-week periods. By mid-July they were on the primary summering areas (Figure 3). It appears that the male sheep associated with the introduced population summer primarily in the Desolation Peaks-Fairchild Mountain area. This area is west of the female group summering area with some overlap on the west side of Fairchild. The area consists of about 717 hectares

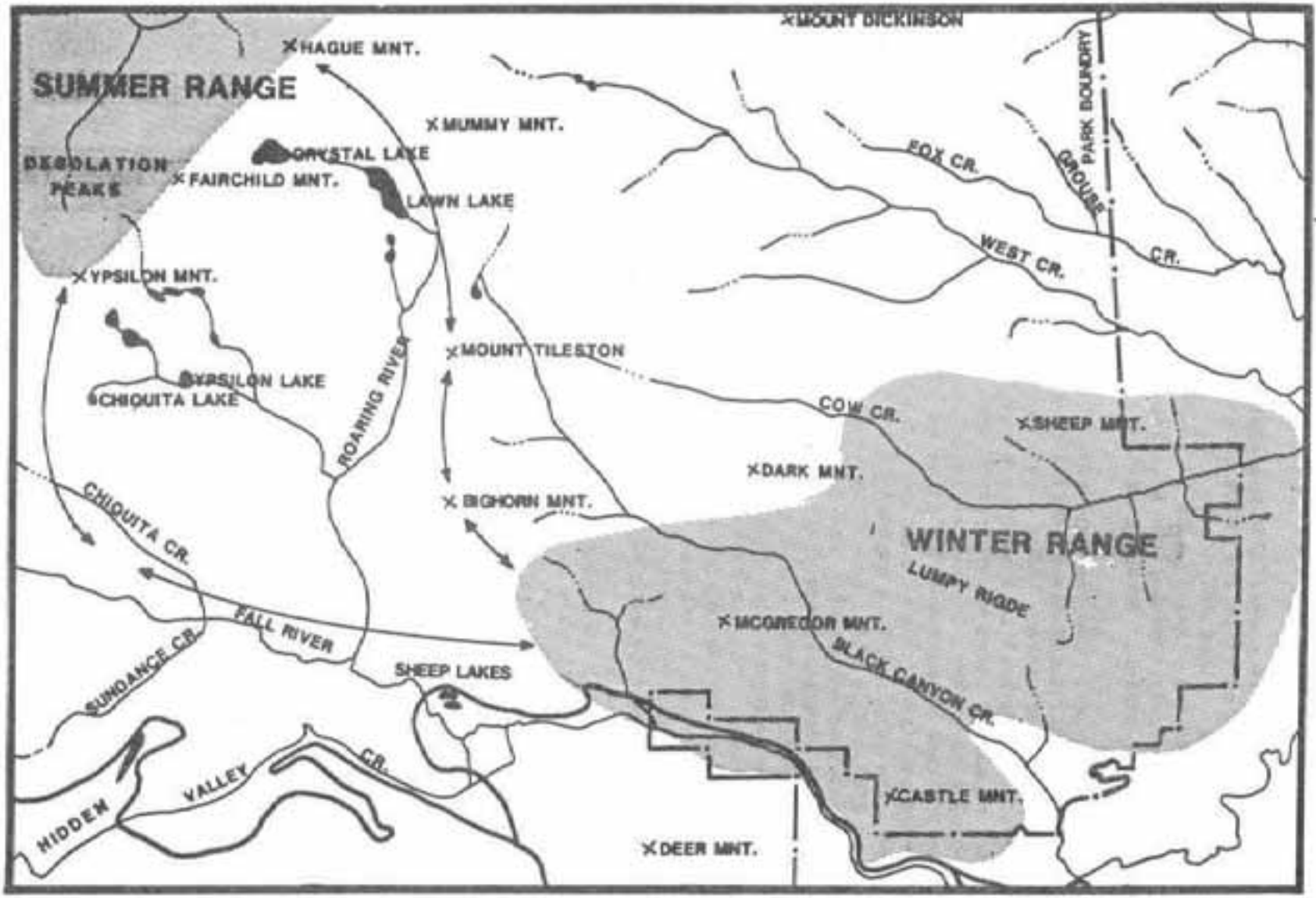

Figure 3. Ranges used by introduced population-male groups.

of very rugged alpine terrain over 3350 m elevation. Topography is mostly steep cliffs, with rock outcrops and talus slopes. Tundra turf is in small patches on these sites. About 30% of the area is open tundra meadow and bogs.

The return to the low elevations is also not well documented for the males. Generally by early November the breeding males were back on the Fall River range with the females. Breeding activity was noted through November and December.

From what we can tell from the relocations made, males that are associated with the introduced sheep generally remain in the low elevation winter range through the winter, but are very mobile. Some may accompany the native rams as they move back to wintering areas in the North Fork and at Rock Cut. However, no marked sheep were observed with these groups.

Total population numbers in the introduced herd were difficult to obtain even with the presence of marked animals due to the vegetation density and size of the area utilized. The erratic movement also complicated such determination. The population is apparently increasing with high counts of 43 in 1982, 59 in 1983, 72 in 1984, and 70 in 1985. This is after the removal of 19 sheep for transplant purposes by the Colorado Division of Wildlife in 1983.

Through ground counts reproduction in the population was indicated by lamb/ewe ratios of 69/100, 68/100 and 52/100 in 1983, 1984, and 1985, respectively. These were made in the fall on the winter range so summer mortality is considered. The native herd appeared to have lower reproductive success with counts of 38/100, 60/100 and 41/100 in the same three years.

Kopec (1982) reported a lamb/ewe ratio of 57/100 in the 1979 Cut Off transplanted population 2 years after introduction in Montana. Similar ratios of 56/100, 53/100, and 49/100 were reported on a native herd in 1982, 1983, and 1984 respectively, on Trout Peak in Wyoming (Irwin and Hurley 1985). Considerably lower ratios were reported for the 1958 to 1977 period with an average of 34/100 for the Whiskey Mountain herds in Wyoming (Thorne et al 1979).

CONCLUSIONS

The results of this study indicate that the original hypothesis may be accepted. The introduced sheep have established a reproducing population that is wintering on the low elevation ranges which had been historic bighorn habitat but not used in recent years. They migrate annually to the high elevation alpine ranges where they spend a portion of the summer sympatrically with the native sheep. The return to the winter range is usually complete by October. The objectives of the 1977 transplant have therefore been met.

The erratic movements to and from the high elevation ranges, and fairly recent pioneering to Castle Mountain may mean, however, that the movement patterns are not absolutely set and new movement behavior still may develop.

The appearance of the native rams on the fall range of the introduced females during the breeding season suggests that interbreeding of the two populations exists. This, of course, could improve the genetic variability and reduce any deleterious effects of inbreeding in the Mummy Range population.

The results of this transplant effort indicate that transplanting even in the close vicinity of a native herd can be used successfully to expand the range use of a population. This can perhaps alleviate some of the problems of bighorn that have been reduced to a small portion of historic range and may be vulnerable to die-off conditions.

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