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ROCKY MOUNTAIN BIGHORN SHEEP TRANSPLANTS IN HELLS CANYON

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Abstract: Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) were extirpated from Hells Canyon by the 1940s, and restoration efforts began in 1971. Translocations have resulted in 15 established herds totaling 780 bighorns. Movements and survival of transplanted sheep based on origin of transplant stock and habitats at release sites were evaluated for 4 recent releases. Three releases were successful and 1 was unsuccessful. Extensive movements to a domestic sheep allotment and/or to other sheep herds are thought to be the reason for the failed transplant. We documented movements up to 80 km (50 miles) from release sites and across major rivers and reservoirs. Sheep from alpine herds seemed to move more than sheep from a canyon population. Migratory alpine sheep may be more suitable as supplements to existing herds. Due to the historically high potential for transplant failure throughout the west, we recommend radiocollaring and regularly monitoring sheep following release in order to determine causes for success or failure.

Translocation of bighorns to historic habitat has been widely used by wildlife managers to increase wild sheep numbers and distribution. Transplants are very popular with the public and have been successful in restoring bighorns to former habitat. Rocky Mountain bighorn sheep populations increased from an estimated 9,700 in 1960 (Buechner 1960) to nearly 34,500 in 1998 (Toweill and Geist 1999). Much of this increase was due to transplants. There have also been many transplant failures (Coggins and Matthews 1996, Enk et al. 1998, Singer et. al. 1999). This study was initiated to intensively follow 4 transplants to determine mortality rates, sheep movements, productivity, and other factors affecting the success of translocations.

HISTORY

Rocky Mountain bighorn sheep were native to Hells Canyon and were thought to be very abundant (Bailey 1936). Archaeological investigations indicate bighorn bones were the most abundant ungulate bones recovered at Native American campsites in Hells Canyon (Randolph and Dahlstrom 1977). Wild sheep were totally extirpated from Hells Canyon in Oregon, Idaho, and Washington by the mid-1940s. Diseases contracted from domestic sheep were believed to have been the major cause of the extinction of Hells Canyon bighorns (Coggins 1980).

Bighorn sheep restoration in Hells Canyon began in 1971 with the release of 40 animals from Jasper National Park, Canada (Coggins and Matthews 1996). Between 1971 and 1999, 415 sheep have been released in Hells Canyon and the surrounding

area from 10 source populations, resulting in 15 established herds (Hells Canyon Bighorn Sheep Recovery Committee, unpublished reports 1996, 1997, 1998, 1999). The March 2000 population estimate was 780 animals (Hells Canyon Bighorn Sheep Recovery Committee, unpublished data). This study evaluates 4 recent transplants and reasons for success or failure. Information from other earlier transplants in the Hells Canyon area is also discussed. The project is part of the Hells Canyon Bighorn Initiative to restore extirpated wild sheep to Hells Canyon.

STUDY AREA

Hells Canyon of the Snake River is located in Oregon, Idaho, and Washington. Elevations range from about 240 m (800 ft) near Lewiston, Idaho to above 2740 m (9,000 ft) in the Seven Devils Mountains, Idaho and Wallowa Mountains, Oregon. Much of the area is public land administered by the Wallowa-Whitman National Forest. Grazing by cattle occurs in portions of Hells Canyon but most domestic sheep allotments have been eliminated on public land. Historically, pneumonia outbreaks, believed to be caused by contact with domestic sheep or goats, resulted in serious adult losses and subsequent depressed lamb survival in some transplanted herds (Coggins and Matthews 1996).

Terrain is steep and sharply dissected. Perennial bunchgrass plant communities interspersed with cliff rock, Douglas fir (*Pseudotsuga menziesii*) and Ponderosa pine (*Pinus ponderosa*) stringers typify Hells Canyon. Climate is characterized by light precipitation. Summers are hot and winters mild (Johnson and Simon 1987).

METHODS

Between 1997 and 1999, 53 Rocky Mountain bighorns from 3 source herds (Cadomin Mine, Hinton, Alberta; Spences Bridge, British Columbia; and Lostine, Oregon) were translocated to 3 vacant sites: Muir Creek, Oregon; Big Canyon, Idaho; and McGraw Creek, Oregon, and 1 occupied site: Asotin Creek, Washington. A summary of sheep released follows:

1. Asotin Creek: 10 animals (8 ewes, 2 rams) from Spences Bridge supplemented an existing herd of 10 sheep in December 1997.
2. Big Canyon: 15 animals (11 ewes, 4 rams) from Spences Bridge released at a vacant site in December 1997; supplemented with 6 additional sheep (3 ewes 3 rams) from Hinton in February 1999.
3. Muir Creek: 13 animals (9 ewes, 4 rams) from Spences Bridge released at a vacant site in December 1997; supplemented with 14 sheep (11 ewes 3 rams) from Hinton in February 1999.
4. McGraw Creek: 15 animals (9 ewes, 6 rams) from Lostine released at a vacant site in January 1999.

All sheep, except 4 lambs, were equipped with mortality-sensing radio-collars and monitored by aircraft or from the ground at least every 2 weeks. All animals were ear-tagged with individually numbered Alflex tags to assist in ground identification. Animals with transmitters on mortality signal were located as quickly as possible to determine the cause of death. Ewes were located approximately weekly during lambing to determine productivity.

RESULTS

Adult survival and dispersal

Spences Bridge Source Population

Thirty of 38 Spences Bridge sheep (79%) released in December 1997 were still alive in April 2000 (2 years 4 months post release).

Survival was highest for sheep released at Big Canyon (88%) (Fig. 1). One ram lamb released at Big Canyon dispersed to another bighorn herd (the Lower Hells Canyon herd). Survival of sheep released at Asotin Creek was lowest (60%) and no sheep dispersed to other herds. Survival at Muir Creek was intermediate (77%). Two ewes from Muir Creek dispersed to another herd (Imnaha). One of these ewes died and status of the other is unknown due to radio failure.

Causes of mortality were mostly unknown (N=5) because scavengers or predators consumed the carcasses prior to their being examined. Two rams died within 2 weeks of release. Documented causes of mortality included 1 cougar kill, 1 Nez Perce tribal hunter kill, and 1 case of bacterial meningitis.

During the first year post-release, 24% (N=9) of bighorns moved from the release site in 4 independent movement events. Seven (18%) of the 38 released sheep crossed the Snake River in 2 movements. Three bighorns (8% of those released: 2 ewes and 1 ram lamb) permanently moved to other herds, and 1 subsequently died.

Hinton Source Population

Twenty bighorns from the Cadomin Mine, Hinton, Alberta were released at Muir Creek (N=14) and Big Canyon (N=6) in February 1999. Sixteen (80%) were alive in April 2000 (1 year 4 months post release). All 6 sheep released at Big Canyon survived, while 4 (29%) Muir Creek sheep died. One ewe died from unknown causes shortly after release (completely scavenged), and 3 sheep dispersed to other areas and died: 1 cougar kill, 1 road kill, and 1 pneumonia.

By October 1999, 58% (N=11) of the Hinton sheep had traveled away from release areas in 12 independent movement events (1 or more sheep moving away from the release site). Five bighorns (25% of those released) permanently moved to other herds and 4 subsequently died. Median distance moved was 21 km (13 miles) for both dispersal and exploratory movements. The maximum distance moved was 80 km (50 miles), by an adult ewe. Sheep crossed the Snake River in half of the movements (27% of sheep released). Nearly all rams exhibited some major movements away from release sites, but only 2 of 6 relocated permanently. Two yearling rams dispersed to the Imnaha herd where 1 was later killed by a cougar. About half of the ewes made major movements, but only 2 dispersed to other ranges. One yearling ewe dispersed to the Big Canyon herd and survived. An adult ewe dispersed to the McGraw herd where she died of pneumonia.

Lostine Source Population

Fifteen bighorns from the Lostine herd were transplanted to McGraw Creek in January 1999. Nine (60%) were alive in April 2000 (1 year 5 months post release). The sheep were released on the Oregon side of Hells Canyon Reservoir where no domestic sheep are present. Unfortunately, an active summer domestic sheep allotment exists on the Idaho side. Five rams and 4 ewes from the transplant crossed the reservoir and were located at least once on the active domestic sheep allotment. While bighorns were never seen making contact with domestic sheep, they were located within 1 km of a range band on several occasions. Two bighorn rams that had visual symptoms of respiratory disease (coughing, sneezing, and nasal discharge) were shot in August 1999. Antibody titers to Parainfluenza-3 virus were elevated (1:64) from those at capture in January (1:8), but necropsy revealed no gross or histological evidence of pneumonia. High summer lamb mortality and observations of coughing indicate this herd suffered respiratory disease problems likely related to domestic sheep contact, either directly or through contact with other infected bighorns. Two dead

bighorns (1ewe, 1 ram) were recovered in poor condition but no evidence of pneumonia was found. Another ewe appeared to be killed by a cougar.One ewe and a ram dispersed to the adjacent Upper Hells Canyon herd.

Lamb survival

Average lamb survival to 8 months of age was highest for the Spences Bridge source population (67%) and lowest for the Lostine sheep released at McGraw Creek (0%) (Table 1). Lamb survival of Spences Bridge ewes (the only release where a comparison could be made) was lower the year immediately after the transplant than the following year. Lamb survival was also lower for sheep released at Muir Creek than Big Canyon, possibly because more yearlings were released. They were less experienced and may have had smaller lambs. More Hinton ewes were released at Muir Creek and they moved more which may also have increased lamb losses. No McGraw Creek lambs survived in 1999, although all 9 ewes released had lambs. Based on movements and disease-related mortality in adults, we believe disease accounted for most of the lamb mortality in that herd.

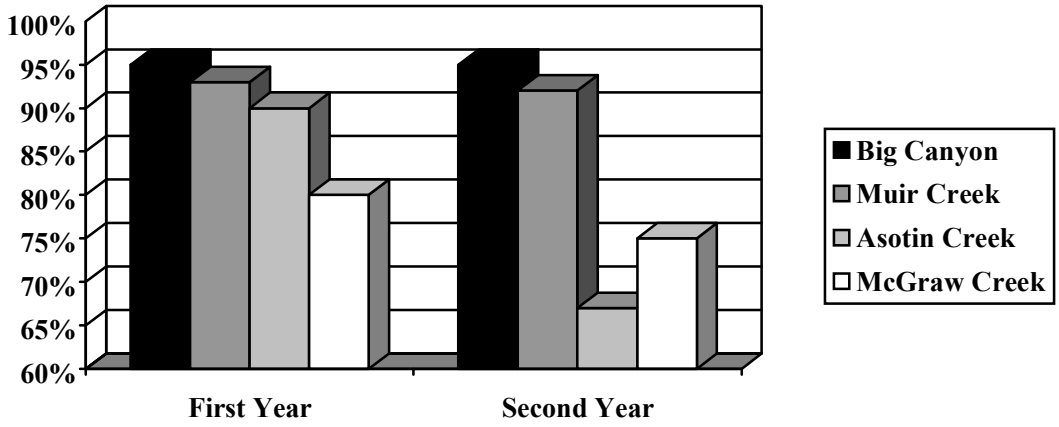

Fig. 1. Annual survival of transplanted bighorn sheep from 1998 to 2000.

Table 1. Hells Canyon lamb survival to 8 months of age by release site and source population.

Year	1998	1999		
Source population	Spences Bridge	Spences Bridge	Hinton	Lostine
Release site				
Big Canyon	67%	91%	67%	
Muir Creek	29%	71%	38%	
Asotin Creek	71%	63%		
McGraw Creek				0

DISCUSSION

During previous transplants, dispersal has been a major cause of transplant failures in Hells Canyon. Dispersal of individuals has varied considerably depending upon source of transplant stock. Sheep from Salmon River, Idaho and Wildhorse Island, Montana source populations have moved the least. Source stock from other herds have moved more frequently with some Hinton and Lostine bighorns moving great distances (Coggins and Matthews 1996).

Although the Spences Bridge sheep were released into unoccupied habitat and the Hinton transplant was a supplement, the sheep transplanted from Hinton moved more often, and were slightly more likely to disperse to adjacent herds than the sheep from Spences Bridge. Another 37 Hinton bighorns were released at Minam River, Oregon and Big Sheep Creek, Oregon in February 2000. These were vacant sites, and preliminary information indicates dispersal to locations greater than 71 km (44 miles) by air. While it is still unknown if dispersers will return to release sites, some bighorns moved to agricultural areas and towns, increasing their risk of pathogen transmission from farm flocks of domestic sheep or of being hit on highways. Because of their propensity to disperse, Hinton stock may be used more successfully to supplement small, established herds.

Prior to this transplant, no radio-collared resident sheep (mostly ewes) in 3 herds (Lower Hells Canyon, Oregon, Redbird, Idaho, or Black Butte, Washington were documented crossing the Snake River. Sheep did cross the Snake River during previous transplants and sheep released in the three study herds on the Snake River initially repeatedly crossed the Snake River or Hells Canyon reservoir. Rams continue to move readily across the Snake River and may summer with one herd and winter with another. Both ewes and rams cross Hells Canyon Reservoir.

These movements may add to the genetic exchange between bighorn herds but also increase the potential for disease transmission. This is especially true for the McGraw Creek transplant, where 53% of the bighorns have crossed Hells Canyon Reservoir at least once. In some cases, ewes lambed on one side of the reservoir and swam with new lambs back to the other side. This is of major concern because they moved to an active domestic sheep allotment on the Payette National Forest.

Although predation can be a significant source of mortality in transplants, predation on the 4 study herds was not a significant factor affecting transplant success. Annual survival rates were 90% or greater for Big Canyon, Muir Creek and Asotin Creek the first year post-release. Disease and management removals in the McGraw Creek herd resulted in a 67% annual survival.

MANAGEMENT IMPLICATIONS

Many early transplants in Hells Canyon had little follow-up monitoring, and if populations failed to become established, the reasons for failure were unknown. This study documented that the primary reason for failure in one transplant was extensive post-release movements increasing the risk of contact with domestic sheep and disease transmission. This resulted in elevated adult mortality and complete loss of lambs.

Major rivers and reservoirs frequently are considered barriers to bighorn movements. This appears to be true for ewes in some resident herds. However, following release, some transplanted bighorns repeatedly crossed the Snake River or Hells Canyon Reservoir. This was especially important for the McGraw herd because of movement to a domestic sheep allotment on the east side of the reservoir.

We observed possible differences in source populations that could affect transplant success. Extensive movements by transplanted individuals can result in failure because few sheep remain near the release sites. Matching habitat characteristics of the source herd with the release area may improve the chance of successful population establishment. Also, supplementing small, established herds rather than releasing sheep into vacant habitat may be more successful with source stock known to be dispersers.

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