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# LAMB SURVIVAL AND HERD STATUS OF THE LOSTINE BIGHORN HERD FOLLOWING A *PASTEURELLA* DIE-OFF

VICTOR L. COGGINS, Oregon Department of Fish & Wildlife, 82119 Fish Hatchery Lane, Enterprise, OR 97828

PATRICK E. MATTHEWS, Oregon Department of Fish & Wildlife, 82119 Fish Hatchery Lane, Enterprise, OR 97828

Abstract: Two-thirds of the Lostine bighorn sheep herd (Northeast Oregon) died during a *Pasteurella* epizootic in winter 1986-87. Circumstantial evidence indicated the disease was transmitted from domestic sheep. Lamb survival was poor the first 2 years following the die-off, but gradually improved thereafter. The current herd status, productivity, and management implications are summarized.

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Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) (Bailey 1936) were native to Northeast Oregon, but disappeared by the mid 1940's. Recent archaeological evidence indicates bighorns were abundant in what is now Wallowa County. Faunal remains from archaeological digs in Hells Canyon indicate bighorns were the most important ungulate food item for pre-settlement Indians.

Restoration efforts in Oregon began in 1971 when 15 ewes and 5 rams from Jasper National Park, Alberta, Canada were released in the Lostine River drainage of the Wallowa Mountains (Coggins 1988). The herd was migratory, wintering on open grass slopes on the north end of the Wallowa Mountains (Lostine Wildlife Area) and summering 8 to 16 km (5 to 10 miles) south in high-elevation alpine basins along the Hurricane Divide. The Lostine bighorns did well and limited ram hunting started in 1978. Trapping and transplanting was initiated in 1977 and 152 bighorns were moved to 9 different sites by 1986. Winter population levels were kept at relatively stable numbers of about 80 sheep by hunting and live trapping.

An all-age die-off from *Pasteurella* pneumonia was diagnosed in November, 1986 and reduced bighorns from an estimated 100 to 34 animals (Table 1). Circumstantial evidence linked the die-off to contact with domestic sheep (Coggins 1988), as has been reported by Onderka and Wishart (1988), Foreyt and Jessup (1982), and others.

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Table 1. Lostine bighorn sheep herd composition and population surveys, 1972-92.

| Year | Ewes | Lambs | Rams | Total classified | Lambs per 100 ewes | Rams per 100 ewes | Highest winter count[a] | Population estimate |
|---|---|---|---|---|---|---|---|---|
| 1972[b] | 14 | 3 | 3 | 20 | 21 | 21 | 19 | 22 |
| 1973 | 13 | 3 | 3 | 19 | 23 | 23 | 19 | 25 |
| 1974 | 17 | 8 | 5 | 30 | 47 | 29 | 30 | 40 |
| 1975[b] | 25 | 12 | 10 | 47 | 48 | 40 | 47 | 55 |
| 1976[b] | 26 | 19 | 8 | 53 | 73 | 31 | 53 | 60 |
| 1977[b] | 24 | 19 | 17 | 70 | 79 | 71 | 63 | 70 |
| 1978 | | No data | | | | | 78 | 85 |
| 1979 | 33 | 23 | 22 | 78 | 70 | 67 | 85 | 95 |
| 1980 | 37 | 19 | 30 | 86 | 51 | 81 | 86 | 95 |
| 1981 | 55 | 11 | 26 | 92 | 20 | 47 | 92 | 100 |
| 1982 | 42 | 16 | 25 | 83 | 38 | 59 | 83 | 95 |
| 1983 | 38 | 27 | 28 | 93 | 71 | 74 | 96 | 110 |
| 1984 | 46 | 25 | 24 | 95 | 54 | 52 | 96 | 110 |
| 1985 | 58 | 19 | 20 | 97 | 33 | 34 | 97 | 110 |
| 1986 | 46 | 15 | 26 | 87 | 33 | 57 | 87 | 100 |
| 1987[c] | 19 | 2 | 11 | 33 | 11 | 58 | 33 | 34 |
| 1988[c] | 21 | 2 | 13 | 36 | 10 | 62 | 36 | 36 |
| 1989[c] | 21 | 2 | 9 | 32 | 10 | 43 | 32 | 33 |
| 1990[c] | 19 | 7 | 8 | 34 | 37 | 42 | 34 | 36 |
| 1991[c] | 21 | 9 | 10 | 40 | 43 | 48 | 40 | 45 |
| 1992[c] | 23 | 10 | 15 | 48 | 43 | 65 | 48 | 55 |

[a] Jan through Apr counts unless otherwise noted. Highest count by ground or supercub aircraft. Includes bighorns transplanted.
[b] Jun through Aug counts on summer range.
[c] Winter range counts involving tagged animals.

## METHODS

Surviving Lostine bighorns were captured in a corral trap and ear tagged with alflex numbered tags. All known surviving bighorns except 1 ram were eventually ear tagged.

Individual records were kept on animal movements, body condition, treatments received, blood and nasal test results through January 1992. Herd composition counts were conducted in June-July on the summer range and again in December-February on the winter range. Trapping was conducted during mid-winter to tag surviving lambs and collect blood samples and nasal smears. Cotton tipped swabs were used to rub the nares. Nasal swabs were placed in Amies transport medium and submitted within 48 hours after collection to the Washington Animal Disease Diagnostic Laboratory, Pullman, Washington, for bacteria analysis. Bacterial isolates were confirmed by biochemical testing (Carter 1984). Biotyping and serotyping methods for P. haemolytica were completed using established formats (Biberstein 1978, Frank and Wessman 1978). Replicate ground counts were made from December through February on the winter range until observers were satisfied that the census was complete. Ear tag numbers were recorded on individual record cards that aided in the accuracy of the surveys. Marked animals that were not located for 2 years were considered dead.

## RESULTS AND DISCUSSION

### Lamb Survival Since Die-Off

June-July lamb production counts indicate lamb:ewe ratios varying from a low of 43:100 in 1988 to 71:100 in 1990 (Table 2). December-February herd composition counts (Table 2) indicated lamb survival was poor the first 2 years following the die-off with lamb ratios of 11 and 10:100 ewes in 1987 and 1988, respectively. Survival increased from a low of 22% the first lambing period after the disease outbreak to 66% in 1991.

Table 2. Bighorn lamb:ewe ratios from surveys conducted during June-July and December-February, and percent lamb survival between July and December counts, 1987-91.

| Year | June-July Lambs/ 100 ewes | (n) | December-February Lambs/ 100 ewes | (n) | Percent Survival |
|---|---|---|---|---|---|
| 1987 | 50 | (21) | 11 | (21) | 22% |
| 1988 | 43 | (30) | 10 | (23) | 23% |
| 1989 | No data | | 37 | (36) | |
| 1990 | 71 | (36) | 43 | (30) | 61% |
| 1991 | 65 | (28) | 43 | (33) | 66% |

Poor lamb survival following Pasteurella die-offs has been reported by Onderka and Wishart (1984), Festa-Bianchet (1988), and Foreyt (1988). Foreyt (1988) reported lambs born to captive ewes shedding P. haemolytica in nasal secretions were healthy until 6 to 11 weeks of age when they developed pneumonia and died. In his study, all lambs died for 3 years after the pneumonia outbreak. Festa-Bianchet (1988) also reported low recruitment following a pneumonia epizootic. In the Alberta study, only 13% of the lambs born the year of the die-off (1985) survived to 1 year of age. Lamb survival 2 years later was 41% (1986) and 36% (1987), respectively. Onderka and Wishart (1984) also reported low lamb production and survival the 2 years following a die-off in southern Alberta. Lamb:ewe ratios were 23 and 18:100 in 1983 and 1984, respectively, following the disease outbreak.

Time of Lamb Losses

The timing of lamb losses appeared to be similar to that reported by Foreyt (1988). Most Lostine lambs were born between 15 May and 1 June. July herd composition lamb counts were conducted on the summer range when lambs were 6 to 8 weeks old. Random counts conducted between September and November indicate lamb losses had occurred by this date. A few sick lambs (generally smaller in size than normal) were observed during this time period, but by December when winter surveys began, lambs generally looked healthy. Visual observations of lambs pre- and post-disease, suggest a greater proportion of poor quality lambs (smaller body size) since the die-off; however, information on body weights were not obtained.

Lambs less than 11 weeks of age born to ewes surviving a Pasteurella die-off may be protected by colostral immunity as reported by Foreyt (1988). Our observations indicate lamb mortality began shortly after birth; however, most lamb mortality occurred after 15 July at a time when consumption of milk appears to be dropping as grasses and forbs make up an increasing proportion of their diet.

Lambs born in 1987 and 1988, that survived until winter, also suffered a 50% mortality through winter 1991-92. Both 1987 lambs have survived to date, but the 2 1988 lambs (1 male, 1 female) were last seen in spring 1989 and are presumed dead. Survival of lambs beyond winter counts was difficult to assess in 1989-91 since fewer survivors were ear-tagged.

Adult Survival Since "Die-Off"

Twenty ewes (1 year or older), 2 lambs, and 12 rams (1 to 4 years of age) survived this die-off. Six of these adult ewes, have since been found dead or disappeared and are presumed dead, for a 70% post die-off survival rate. Two ewes died or disappeared in 1988, 1 in 1989, and 3 in 1990. Four ewes were seen with injuries, in poor condition, or appeared lethargic prior to their disappearance. Predation could have been a factor in at least 1 case judging from injuries on the animal. Of the 2 lambs, a female and male, only the female appeared to have survived. The ram was last seen in 1990 as a 4 year old, 16 km north of the winter range in flat agricultural land.

Six of the 12 surviving rams (50%) have disappeared and one 7 1/2 year old was taken by a hunter in 1991 (the first year sheep season reopened). Four rams were last seen in 1988 and they were 3 and 4 years of age at that time. Two 4 year old rams were last seen in 1989 and 1990. Why post die-off ram survival was lower than for ewes is unknown. It is possible that some emigration occurred, but no tagged Lostine rams have been observed in other herds. None of the rams unaccounted for appeared in poor condition or were noted with injuries as was the case with ewes. Poaching or cougar predation are other possibilities, but known illegal kills have rarely occurred in the area. The cougar population is moderate to high in this unit (Minam Wildlife Management Unit) and a few rams killed by cougars were found in past years when sheep population densities were higher. Harrison and Hebert (1988) found that cougars were selective in preying on rams in British Columbia and that kills were seldom located without intensive searches of gully bottoms and thickets. They also found the heaviest mortality in November and December after the rut. Older Lostine rams generally moved away from lamb-ewe groups, following the rut, to winter range that had more cover. Presumably this could make them more vulnerable to cougar predation. However, no dead rams were found or reported since the die-off, but brushy bottoms and thickets were not searched.

### Herd Recovery

Bighorn losses from the Lostine die-off took 2 forms. The direct losses from the disease reduced the herd by 66% and poor lamb survival kept the herd at static levels for 3 years following pneumonia episodes (Fig. 1).

Herd size began a slow increase as lamb survival improved (Table 1) and 40 animals were counted the winter of 1990-91. This past winter (1991-92), 48 bighorns were counted and the herd size was estimated at 55 animals. Lamb survival appears to be approaching normal levels with 43:100 ewes classified on the winter range.

Ram numbers are also increasing with 15 rams located this past winter or 65:100 ewes. Most rams are 1 to 3 years old, the result of improved recruitment since 1989. Only 6 rams between 7 and 9 years of age are known to be in the herd.

### Disease Testing

Nasal swabs and blood samples have been collected from bighorns captured on the winter range. It is beyond the scope of this paper to report on these results. However, test results from nasal swabs appear to indicate a drop in Pasteurella spp. shedding by adults.

## MANAGEMENT IMPLICATIONS

The Lostine Pasteurella die-off has had a devastating impact on Oregon's Rocky Mountain bighorn recovery program. This herd was used as a source of transplant stock as well as providing the bulk of hunting

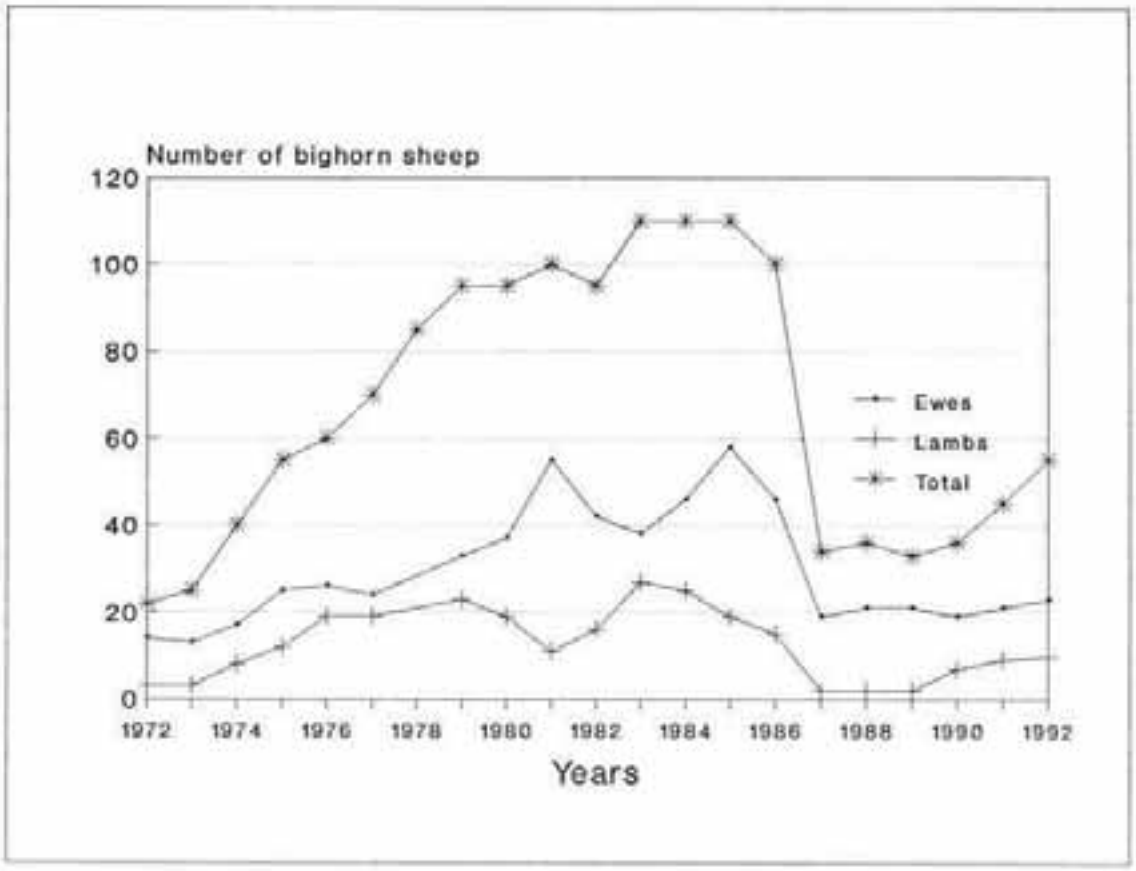


Fig. 1 Lostine bighorn sheep herd composition and population status based on surveys conducted during winters 1972-92. Excludes 1978 when no data were collected.

opportunity. Bighorns have not been transplanted from this herd since 1986. Ram hunting opportunity dropped from 6 tags authorized annually from 1979 to 1986, to no hunts authorized from 1977-90. One tag was offered in 1991 and future tag numbers will be increased if the herd size and ram numbers continue to grow. There is a gap in the age structure of the ram segment of the herd with no known surviving rams between the ages of 4 to 6 and 10 to 12+ years. Hunting opportunity for trophy quality rams will be very limited until the age structure becomes more evenly distributed.

The disease problem also had other implications to Oregon's Rocky Mountain bighorn (RMB) programs. Only 1 RMB transplant in an adjacent wildlife district has been completed since the 1986-87 die-off. Disagreement between Oregon Department of Fish and Wildlife (ODFW), and the Wallowa-Whitman National forest over domestic sheep grazing on sites occupied by bighorns led to a cancellation of all bighorn transplants on the forest. Considerable controversy occurred when hunting and conservation groups, several Indian tribes and livestock interests entered the dispute. Agreement between ODFW and Wallowa-Whitman National Forest was finally reached this past winter and several

transplant sites on the forest will be available in the future to continue restoration efforts. Attitudes are changing. ODFW completed several controlled burns on bighorn ranges during Spring 1992. These habitat projects were partially financed by the Foundation for North American Wild Sheep in cooperation with the Wallowa-Whitman National Forest. Hopefully, restoring Oregon's Rocky Mountain bighorns to suitable former range will proceed in a more timely manner with multi-agency support.

There are several other management questions regarding bighorn herds surviving Pasteurella die-offs that need to be answered:

1. At what point (if ever) should supplemental transplants be considered?
2. Should bighorn herds that have recovered from a Pasteurella outbreak be used for transplant stock? If so, at what point should trapping and transplanting begin?
3. What are the risks (if any) of contact between bighorns from a "recovered" herd and adjacent "healthy" animals.

## MANAGEMENT RECOMMENDATIONS

The main lesson learned from the Lostine disease problem is to keep domestic sheep and bighorns separated. When contact occurs, serious long-term disease problems and drastic reductions in bighorn numbers and lamb survival can be expected.

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