

THE IMPACT OF COYOTE PREDATION ON LAMB MORTALITY PATTERNS AT THE JUNCTION
WILDLIFE MANAGEMENT AREA

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Abstract: Lamb/ewe ratios at the Junction Wildlife Management area in central British Columbia, have been declining since the late 1970's. Although the pregnancy rate reaches 95%, lamb/ewe ratios declined to 25-30/100 ewes in August and 12-18/100 ewes the following March. Preliminary examination of range condition, nutrition, stress, parasites and disease and climate indicated that these factors were probably not the cause in the decline of the lamb/ewe ratios. The year following extensive coyote control, lamb/ewe ratios increased 2-3 times in August and March.

The Junction Wildlife Management Area (W.M.A.) contains the largest, northernmost population of California bighorn sheep (Ovis canadensis californiana) in North America (Fig 1.). This sheep population is non-migratory, remaining on the banks of the Fraser and Chilcotin rivers year round. It is composed of the Deer Park herd of approximately 150 sheep and the Junction herd of approximately 400-450 sheep. These bands are separated by 7-10 km. and, although the ewes and lambs intermingle infrequently, the ram population (approximately 150) moves freely between the two areas. The area is provincially renowned for its high quality ram hunting (1000 limited entry hunt applications for 5-9 permits) and for its accessibility to nonconsumptive users (up to 3000 user days/year). In addition, its international reputation is based on a 34 year history of transplants to 6 western states in the U.S.A. Approximately 250 sheep have been transplanted during this period, resulting in a present day population in those states of 2500-3000 animals (Hebert unpub., Thorne 1986).

Since the late 1970's, lamb/ewe ratios and recruitment levels declined drastically as did the size and availability of legal rams in the harvest. It was apparent that these conditions could curtail or reduce both the transplant and ram harvest programs. Programs were designed to determine the influence of climate, range condition, nutritional status, health of the herd and reproductive status on lamb production and recruitment. Poaching was suggested as the primary cause of the decline in ram horn size and ram population numbers. Preliminary analysis of data

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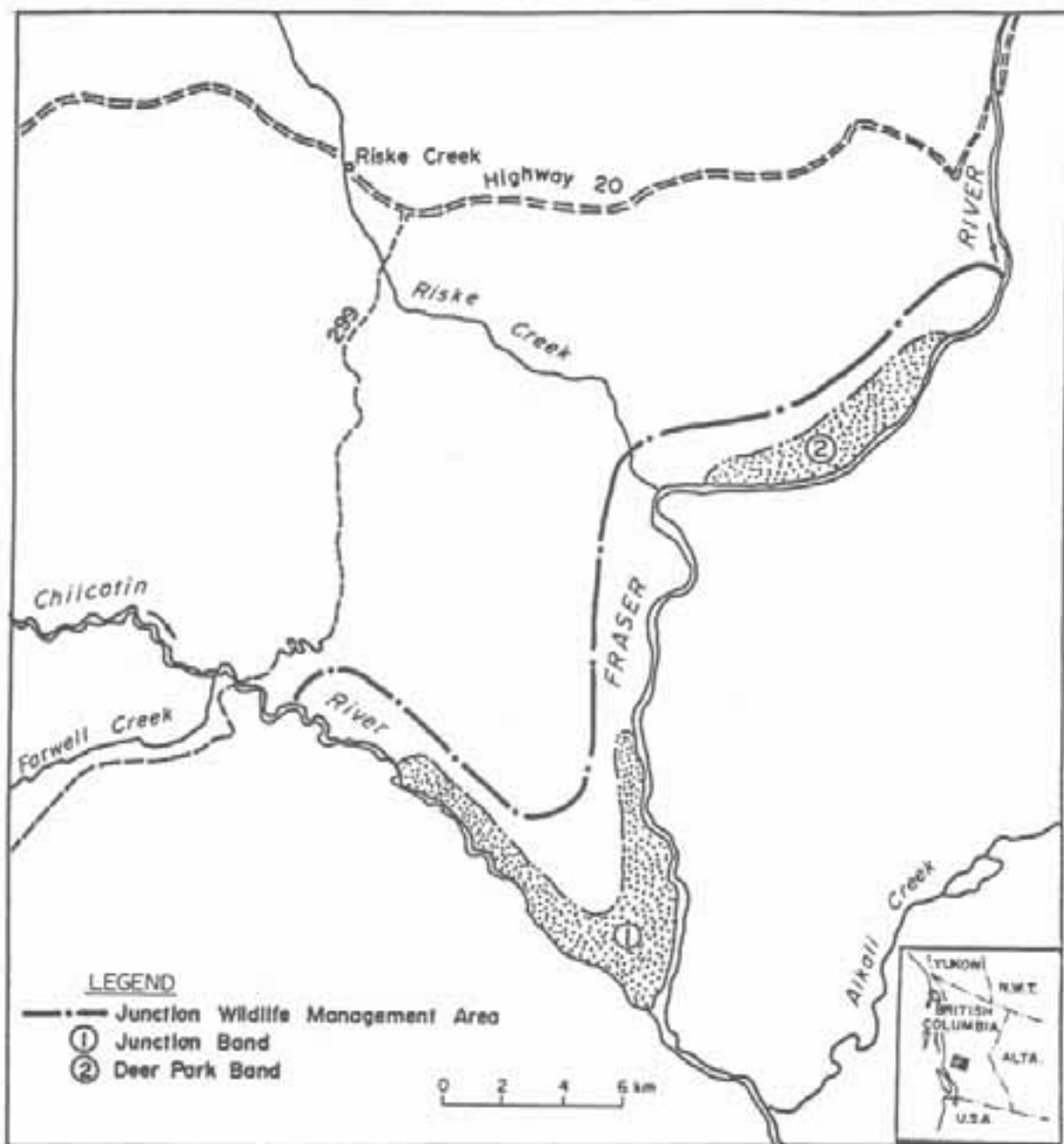


Figure 1. The Junction Wildlife Management Area indicating the Junction and Deer Park bands of sheep.

from these programs suggested that these variables had a minimal influence on either lamb survival or ram availability.

During the study period, information on predator sightings and approximate numbers on observed predation (Harrison and Hebert 1988) suggested that it might play a role in the growth and structure of the Junction sheep population.

Predator populations have never been monitored closely. However, cougar, coyote and wolf populations were severely reduced during the period 1940-1975, due to poison programs, trapping and intense hunting.

This paper examines the relationship between coyote predation and lamb production and survival on the Junction sheep range from the mid-1970's to the present.

STUDY AREA

The Junction W.M.A. is comprised of approximately 6,000 hectares at the confluence of the Fraser and Chilcotin Rivers. It is composed of grassland covered benchlands, interspersed with patches of Douglas fir on north slopes and wetter seepage sites. The study area is larger than the W.M.A. and contains approximately 225 km² (Fig. 1).

METHODS

Helicopter surveys were conducted on the two sheep bands between 1968-1988 to determine lamb/ewe ratios at various periods throughout the year and to approximate population numbers. Minimum counts were used in most years, however, in some years replicated counts and marked-unmarked ratios were also used. Ground surveys were often used to supplement aerial surveys to support or adjust composition data.

Pregnancy testing was done during several trapping operations using serum progesterin (Ramsay and Sadler 1979). Lamb mortality patterns using lamb/ewe ratios, were determined from consecutive searches of the lambing grounds between April and September 1984 (Caldwell unpub.). Nutritional levels and seasonal food habits were undertaken between 1981 and 1986 (Hebert et al. 1984, Hebert 1986). Stress level in the population was examined using serum cortisol (Hebert and Spraker unpub.) and population health was examined through necropsy (Spraker unpub.). General range condition was examined (Demarchi unpub.) and is improving, although several critical winter ranges used during severe winters have remained stable but in poor condition. Climatic data for the area has shown that winters have been light to moderate for 5 of the last 6 years.

The coyote population in the Deer Park area was controlled by ranch hands (shooting) during the mid-1970's through to 1988. At the Junction, coyotes were controlled by trapping and shooting during the winter of 1986-87 and 1987-88.

RESULTS

Examination of range, climatic, nutritional, health and reproductive

status suggested that these variables were insignificant in the regulation of lamb production and survival.

Aerial survey data collected between 1968 and 1980 (Table 1) indicated that lamb survival was at least moderate in most years.

Table 1. Lamb/100 ewe ratios for the Junction-Deer Park bands of California bighorn sheep during late summer and midwinter.

| Date | August | Nov. - Feb. |
|-------------------|-----------------------|-------------|
| 1968 | 38 (302) ^b | 22 (203) |
| 1969 | 44 (174) | 45 (185) |
| 1970 ^a | 29 (161) | |
| 1971 | 39 (209) | |
| 1974 | 41 (124) | |
| 1975 | | 37 (109) |
| 1979 | | 45 (331) |
| 1980 | | 20 (284) |

^a September

^b () = sample size

The data combines information from both the Deer Park and Junction herds. During this time, ranchers at the Deer Park herd were undertaking some coyote control that could increase the lamb survival figures by an unknown amount. Since the largest proportion (80 percent) of the population occurred at the Junction, where no coyote control was undertaken, the lamb/ewe ratio of the combined data was only partially influenced.

Throughout the period 1982-1985 (Fig. 2), approximately 95% of the ewes tested during trapping and transplant operations were pregnant. During the lambing period, April 10 - June, the highest lamb/ewe ratio observed was 70 (Fig. 1). Lamb/ewe ratios at the Junction declined each summer (1984-86) to 25-30 lambs/100 ewes in August (Fig. 2, 3, 4). Simultaneously, lamb/ewe ratios at Deer Park were maintained at 40-45 lambs/100 ewes for the same month. Between August and the following March (1984-86) lamb/ewe ratios at the Junction continued to decline to 12-18/100, while those at Deer Park were maintained at 30-40/100 (Fig. 2, 3 4).

During the early and mid-1980's, ranch hands at Deer Park were removing 30-50 coyotes/year during the winter trapping season, preceeding the lambing period. During the winter of 1986-87, ranch hands removed 59 coyotes at Deer Park while trappers and hunters removed a minimum of 26 at the Junction. Although 85 coyotes were known to be removed, it is more likely that 95-100 were actually removed. During the latter stages of

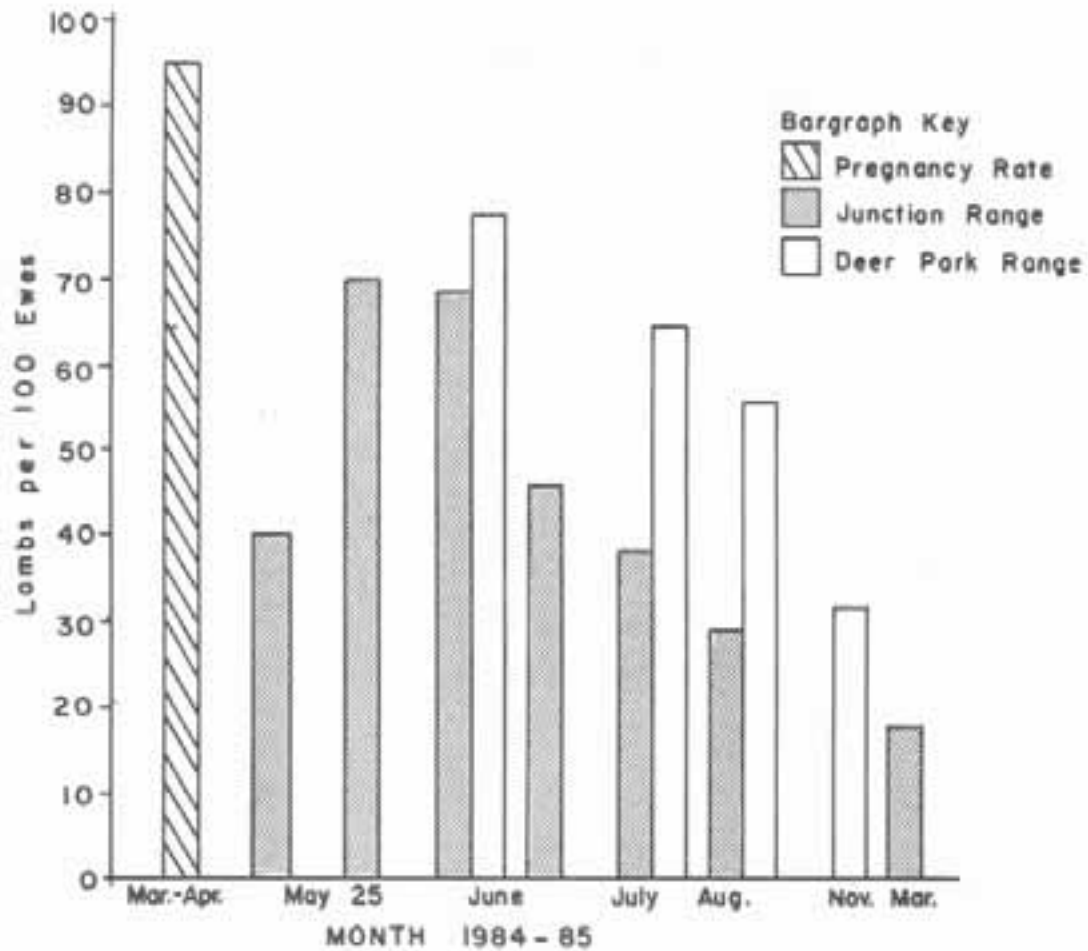


Figure 2. The ratio of lambs per 100 ewes on the Junction Wildlife Management Area prior to coyote control.

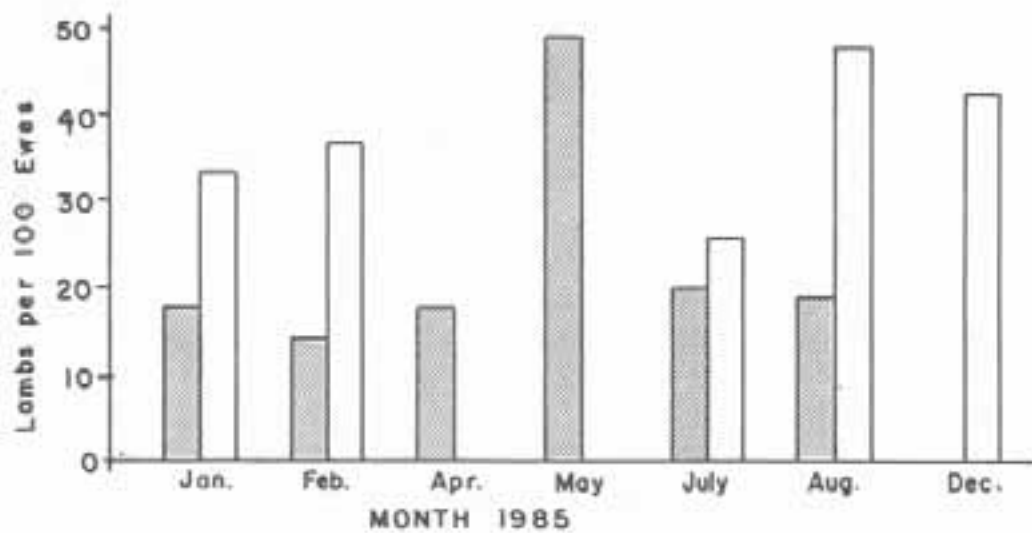


Figure 3. The ratio of lambs per 100 ewes on the Junction Wildlife Management Area prior to coyote control.

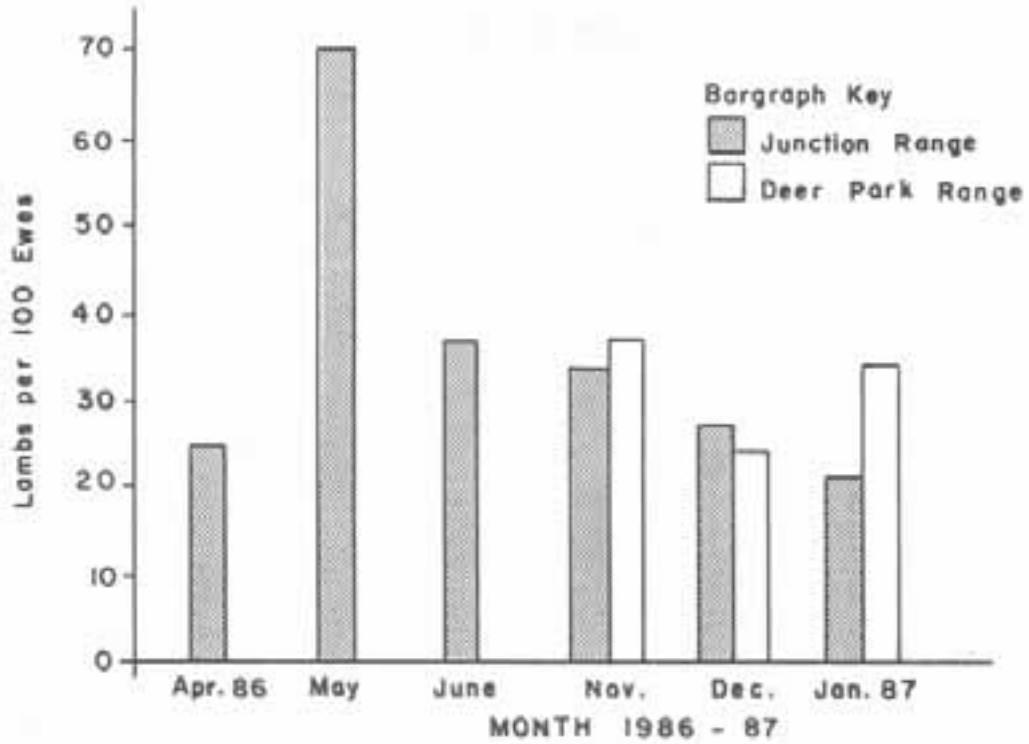


Figure 4. The ratio of lambs per 100 ewes on the Junction Wildlife Management Area following coyote control.

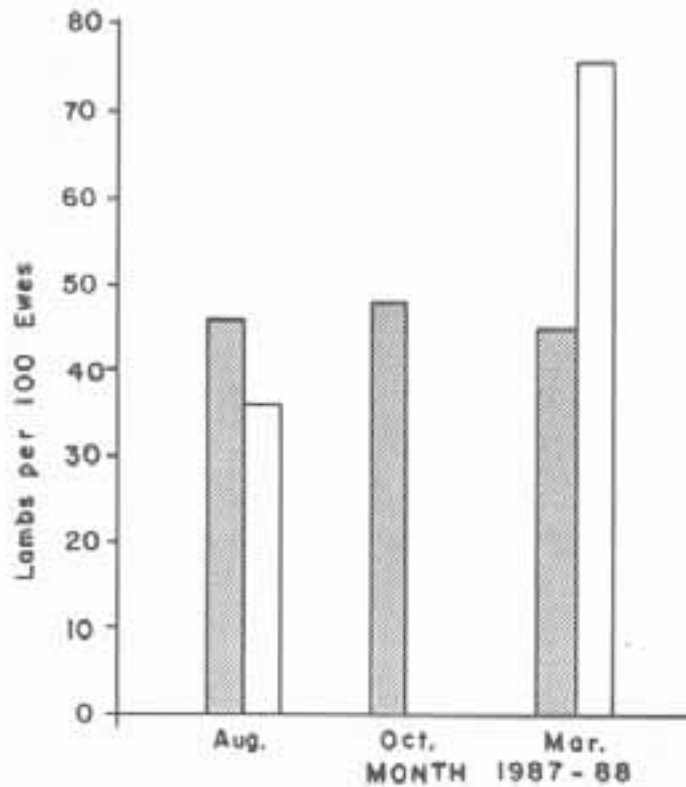


Figure 5. The ratio of lambs per 100 ewes on the Junction Wildlife Management Area following coyote control.

coyote removal it was estimated (tracks after fresh snowfalls) that at least 25-30 coyotes still remained in the study area. As well, preliminary radio tracking data indicated that coyotes moved between the Junction and Deer Park.

Sheep surveys undertaken in August 1987 following coyote control, produced a lamb/ewe ratio of 56/100 at the Junction and 46/100 at Deer Park (Fig. 5). The post control lamb/ewe ratio at the Junction was approximately 2 to 2.5 times higher than during the previous three years. Subsequently, surveys in October 1987 and March 1988 indicated that the lamb/ewe ratio was not declining. The October survey at the Junction produced a lamb/ewe ratio of 58/100. Subsequent surveys in March 1988 produced lamb/ewe ratios of 45 and 76/100 for the Junction and Deer Park, respectively. The post-control, August - March decline at the Junction was only 19.6% as compared to the pre-control decline of approximately 44%. The increase in the Deer Park ratio from 46/100 to 76/100 during the August - October period was likely the result of survey bias due to trapping and the distribution of small ewe groups without lambs. During the October survey, the sample size was reduced and groups were undisturbed and in larger visible groups as they prepared for the rut. Baiting and trapping in late February attracted a disproportionate number of ewes with lambs (20 lambs, 22 ewes) which were added to the surveyed sample. During the March survey, small ewe groups without lambs were less visible due to the disturbance, reduced population size and the complete lack of snow on the winter range. The actual lamb/ewe ratio is somewhere between 46 and 76:100 ewes.

During the fall and winter of 1987-88, 8 coyotes were removed at the Junction and 35 were removed from Deer Park. Intensive field inspections indicated a significant decline in coyote sightings, sign and tracks throughout the entire study area.

DISCUSSION

Biologists throughout the range of bighorn sheep in North America have traditionally examined the role of range condition, nutrition and animal health in relation to population status of bighorns. There are several instances where this approach has not explained the level of lamb survival (Bodie and Hickey 1980, Harper 1984). Several studies indicate moderate to high lamb production and recruitment (Coggins 1980, Whitfield and Keller 1984, Schuerholz 1984) while others note low to moderate ratios (Hass and Decker 1980, Harper 1984) with no apparent reason for the loss.

At the Junction W.M.A., golden eagles, black bear, coyote, cougar and humans all prey on bighorn lambs. Without intensive study, the role of each predator species in lamb mortality is difficult if not impossible to assess. Predation is impossible to assess through normal observational procedures and as a result is almost always underestimated. Peek (1986) suggests that "it should be clearly understood that it is difficult to determine the magnitude of effect predation has in field studies". A few instances of predator activity (coyotes chasing sheep or cougar predation on sheep) usually indicate an underlying predator problem. Evidence of the presence of predators with no evidence of predation does not indicate a lack of significant predation. This study indicated that significant

predator control at Deer Park (approximately 10 years) was responsible for maintaining favorable lamb/ewe ratios. Similarly, predator reduction at the Junction, produced a dramatic increase in the lamb/ewe ratio. Stout (1982) determined that fawn production increased by 154% following coyote control. Horejsi (1976) suggested that coyotes are present in the Sheep River area of Alberta and they do hunt sheep. Fairaizl (1980) indicated that coyote predation was the major cause of lamb mortality following population transplants in North Dakota. Festa-Bianchet (1987) noted that several lamb carcasses were consumed by coyotes and coyotes were observed pursuing sheep on about two dozen occasions.

Without continuous radio-collar monitoring and an understanding of predator population dynamics, the impact of specific individuals or the general predator population is difficult to identify or separate. It may be that only certain individuals, at a variety of predator densities, have learned to prey successfully on bighorn sheep. Alternatively, predator population density may be the ultimate cause of increased coyote predation on bighorn sheep.

Removal programs do not allow these aspects of predator population dynamics or behaviour to be examined. However, removal programs can confirm the impacts of predators and can produce dramatic improvements in survival and population growth, especially where one predator species predominates. Combined impacts of predators are even more difficult to determine.

Coyote control has produced a population surplus which the critical winter ranges could not sustain in a severe winter. Consequently, California bighorn sheep transplants will continue until most or all of the native sheep range in the U.S.A. is repopulated.

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