

**Alberta Conservation Association  
2007/08 Project Summary Report**

**Project name:** Investigating Resource Selection by Bighorn Sheep in Southwest Alberta

**Project leaders:** Darren Dorge and Mike Jokinen

**Primary ACA staff on this project:** Darren Dorge and Mike Jokinen

**Partnerships:**

Alberta Sustainable Resource Development, Fish & Wildlife Division  
Foundation for North American Wild Sheep, Alberta Chapter  
Lethbridge and Fort Macleod Fish and Game Associations  
Lethbridge Community College Chapter of the Wildlife Society  
Shell Canada Limited  
The Rocky Mountain Elk Foundation of Canada  
Veterinarian Richard Kennedy  
Willow Valley Trophy Club  
Waterton Lakes National Park

**Key findings**

- 46 radio-marked ewes were used to assess the survival and demography of the bighorn sheep population (2003 to 2005).
- Annual adult ewe ( $\geq 2$  years of age) survival estimates averaged 87%, and did not differ significantly among years or seasons, nor among core habitat areas, or probable causes of mortality.
- Annual lamb survival to 10 months averaged 45%.
- The estimated recruitment of female lambs surviving to 10 months averaged 18% (95% CI: 12 - 27%) over three years.
- Ewes were found to be spatio-temporally independent and made larger movements during daylight hours compared to nocturnal hours.
- Ewes moved shorter distances during winter compared to summer or fall.
- A manuscript based on sheep demographics will be submitted for peer review publication.

**Introduction**

A bighorn sheep demographic study was initiated in 2002 in the Yarrow-Castle area of Alberta as a collaborative effort between the Alberta Conservation Association (ACA) and Alberta Sustainable Resource Development (ASRD). The results depict a population that is limited in growth, likely by its resources. The population growth rate is slow, and the number of rams

reaching trophy class appears lower than recorded from the 1970s and 1980s. Populations that exhibit slow growth rates, low productivity and low survival have likely exceeded the carrying capacity of their range (Geist 1971). The condition of the resources that are important for sheep in the Yarrow-Castle area is largely unknown; however, fire suppression during the past century has dramatically changed the landscape. Encroachment of shrubs and trees is evident from repeat photography, and has likely decreased the amount of forage, and the extent of open escape habitat. The last recorded wildfire was in 1936 (ASRD 2005). Prescribed burning on sheep range increases herbaceous plants and removes obstructive shrubby plants. Bighorn sheep tend to select for these burned areas (McWhirter et al. 1992; Peek et al. 1979) and populations are thought to benefit from newly formed food sources created by fire, avalanches, and mine reclamation (Wishart et al. 1996). The objective of phase two of this program is to identify resources that may be limiting carrying capacity for this population, and develop a habitat restoration strategy in collaboration with ASRD. Implementation of this strategy will likely fit within the ACA Ungulate Winter Range Restoration Program in future years.

## **Methods**

The initial objective for phase two of this project is to produce a resource selection function (RSF) model of the habitat used by ewes in this area (2003 - 2005). Our initial challenge has been to indentify the number of individual sheep that represent an independent sample.

To test for spatio-temporal association of the individual GPS collared ewes, we used ASSOC1 software, which was designed to calculate an association frequency matrix comparing patterns of similarity to individuals within a group and converting it to a percent (Weber et al. 2001). Within the ASSOC1 software, we defined the spatial threshold to be any two GPS collared ewes within 200 m of each other and a temporal threshold of 50%. Bighorn sheep are gregarious in nature, forming relatively small groups with occasional range overlap between groups. Therefore, two collared individuals that were within a spatial distance of 200 m, at least 50% of the time, were identified as being from the same maternal group and could not be considered independent. We compared an individual movement from one day and time to the next day and time, and then calculated the average distance moved between days. We categorized movements within seasons (winter, summer, fall) and then compared the daily movement averages within these three classes.

During 2007/2008, we engaged in a series of discussions with wildlife experts to discuss the approach and benefits of producing a resource selection function (RSF) model and planning tool. Points of discussion included: appropriateness of the available data, utility of the expected products, and timeframes required to complete the project.

## **Results**

There were 21,793 GPS location points from the 46 ewes monitored over three years. Of these locations, 9,389 were from winter, 6,282 from summer, and 6,122 from the fall. Animal use locations were distributed throughout the study area, although a concentration came from a core area in the south (9,159 locations). There was considerable spatial overlap in the movements and multi-year home ranges (minimum convex polygon method) of individuals (Figure 1). However,

the results of the spatio-temporal analyses indicate that the GPS collared ewes are all independent of one another based on a 50% temporal threshold and a 200 m spatial threshold (Figure 2). Note, that the collared ewes were divided into two groups since ewes in the southern portion of the study area never spatially overlapped with ewes to the north.

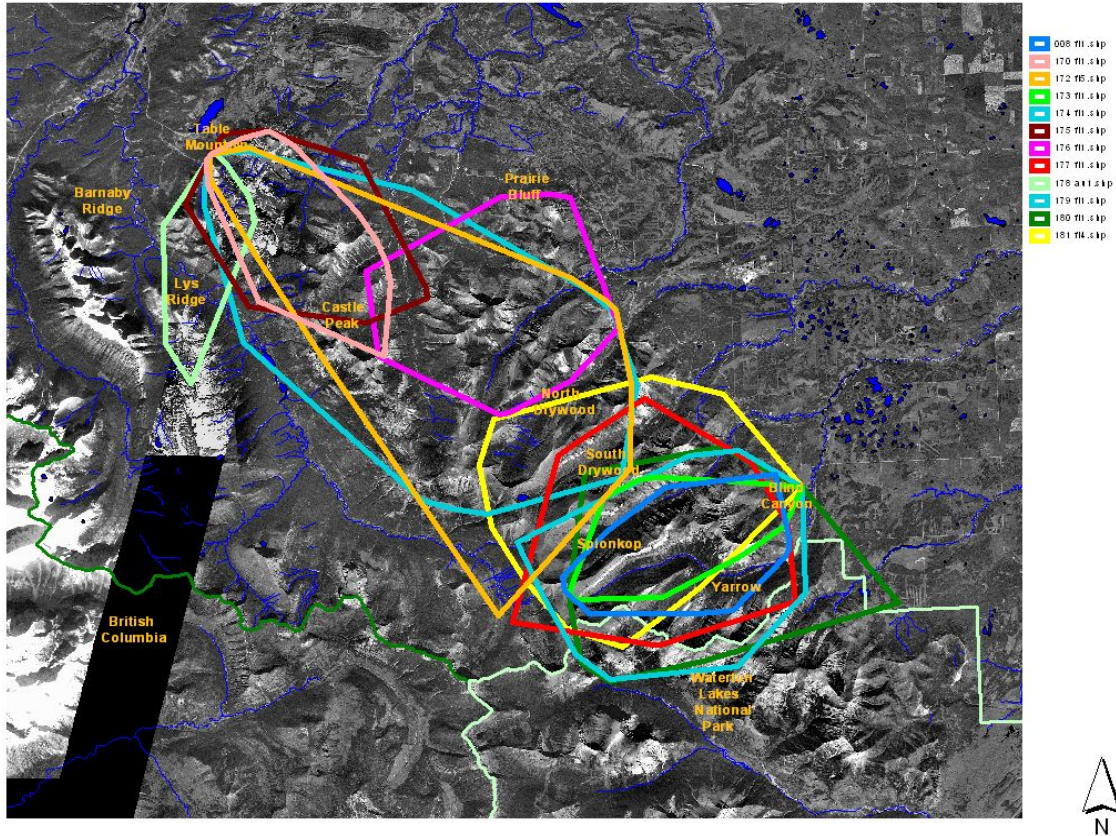


Figure 1. Home ranges of the GPS collared ewes in the Yarrow-Castle area.

Southern Ewe Associations							Northern Ewe Associations						
Similar							Similar						
ID	8	174	180	173	177	181	ID	172	175	176	178	170	179
8	1	0	0	0	0	0	172	1	0	0	0	0	0
174	0	1	0	0	0	0	175	0	1	0	0	0	0
180	0	0	1	0	0	0	176	0	0	1	0	0	0
173	0	0	0	1	0	0	178	0	0	0	1	0	0
177	0	0	0	0	1	0	170	0	0	0	0	1	0
181	0	0	0	0	0	1	179	0	0	0	0	0	1

Figure 2. ASSOC1 program output for Yarrow-Castle GPS collared ewes based on a temporal threshold of 50% and a spatial threshold of 200 m. A 1 represents association, a 0 represents independence.

Ewe movements were greater in the daytime compared to nocturnal periods, and ewes moved the least during the winter period (Table 1.)

Table 1. Seasonal average distance (m) moved by ewe 172 between fix rates (6 h).

Season	Average distance (m) moved every 6 h			
	00:00 to 06:00	06:00 to 12:00	12:00 to 18:00	18:00 to 00:00
Winter	322	660	719	475
Summer	467	826	967	828
Fall	608	986	886	628

After significant discussion with the Provincial Wildlife Team and the habitat modeling group, we decided not to pursue the development of an RSF model at this time. Instead, we will be soliciting professional opinion from sheep experts in Alberta and North America regarding an optimal approach to conducting habitat treatments in bighorn sheep range.

### Conclusion

Bighorn sheep habitat modeling will not be conducted at this time. A sheep-specific guiding document, based on expert opinion, will be provided to the Ungulate Winter Range Restoration Program next year. This report is expected to help identify effective burn locations, size and indicators if range restoration is pursued in the future.

### Communications

- Demographic study results were presented to Lethbridge Fish and Game, Hillcrest Fish and Game, Willow Valley Trophy Club and the Alberta Chapter of the Foundation for North American Wild Sheep.
- The project will also be presented at the 16<sup>th</sup> Biennial Northern Wild Sheep and Goat Council conference in Utah in April 2008.

### Literature cited

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