Whiskey Mountain Bighorn Sheep: the 'West Side Story'

Dr. Kevin Monteith, Principle Investigator, Univ. of Wyoming
Brandon Scurlock, Wildlife Coordinator, WGFD Pinedale Region
Rusty Kaiser, Wildlife Biologist, BTNF

Introduction

The Whiskey Mountain bighorn sheep (WMBS) herd encompasses the northern Wind River Mountain Range in west central Wyoming and is divided into 3 hunt areas (Figure 1). Recognized for years as the largest congregation of wintering bighorn sheep in the country, the herd has been an important component in bighorn sheep management for Wyoming and other western states for many decades. Traditionally, the bulk of sheep in the herd winter in hunt areas 9 and 10 on the northern side of the herd unit near DuBois, Wyoming. These sheep are largely migratory, moving to higher elevation summer ranges as snow recedes. A smaller sub-population of WMBS residing in hunt area 8 are believed to be largely non-migratory, and winter on high elevation windswept slopes in the Upper Green River drainage.

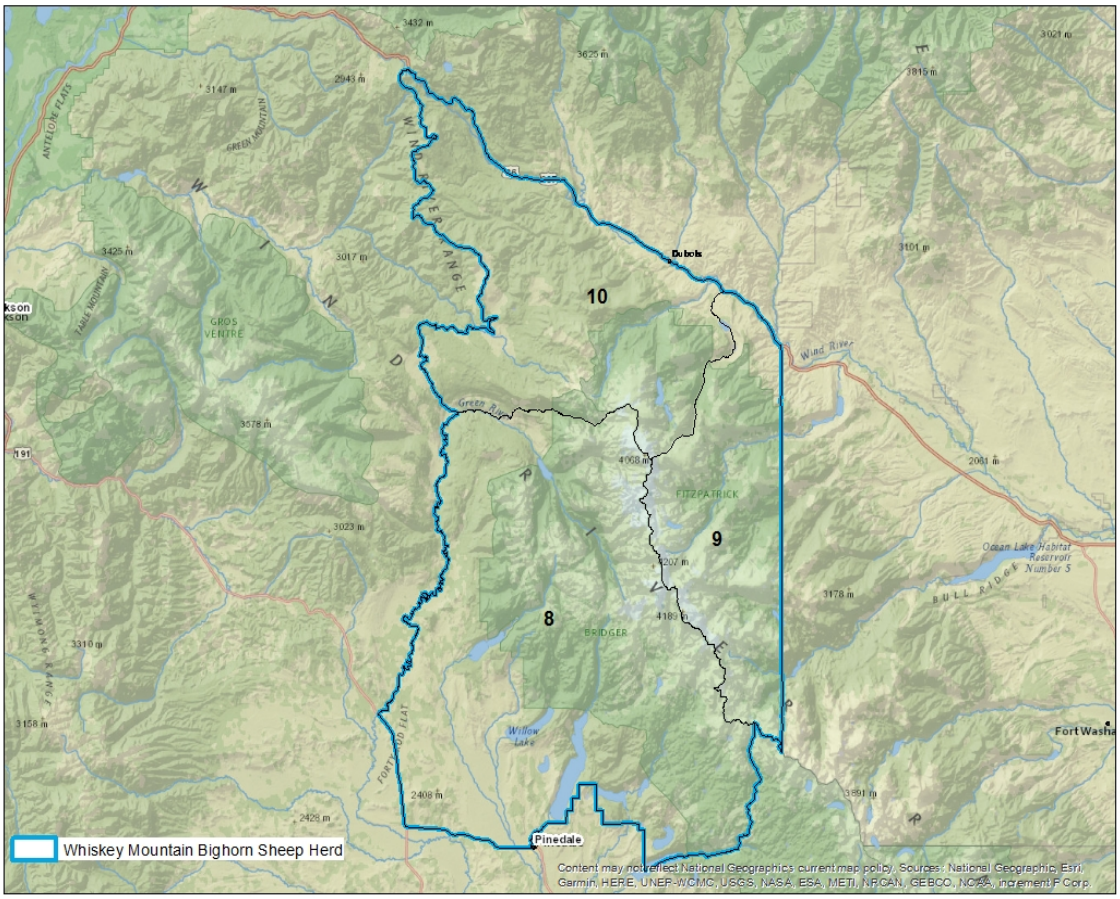

Figure 1. Hunt areas of the Whiskey Mountain bighorn sheep herd.

During the winter of 1990/91, the WMBS herd experienced a pneumonia outbreak that resulted in significant mortality of the migratory sheep in hunt areas 9 and 10. In contrast to other bighorn sheep die-off events throughout the West that gradually recover from pneumonia outbreaks, the WMBS herd has continued to slowly decline presumably because of low lamb recruitment over the past decades. Due to the remote location of the non-migratory segment of WMBS that winter in hunt area 8, little is known about impacts of the pneumonia outbreak on this group of sheep. Helicopter surveys are conducted most winters in the WMBS herd, and trend counts of hunt area 8 sheep have not declined proportional to that of sheep counted in hunt areas 9 and 10. Additionally, lamb:ewe ratios observed during 2019 surveys in hunt area 8 were 34:100, compared with 22:100 and 5:100 observed in hunt areas 9 and 10, respectively.

Although a wealth of research on the effects of disease on bighorn sheep have been conducted, pneumonia continues to be one of the most poorly understood diseases. Recurring mortality within chronically infected herds are likely dependent upon certain ecological or environmental conditions, and understanding these interactions could yield management alternatives to help reduce the frequency of epizootics and dampen fluctuations in abundance. To determine the potential interplay among density, nutrition, and immune function for disease in the WMBS population, the Wyoming Game and Fish Department (WGFD) and the University of Wyoming (UW) initiated a lamb survival study in hunt areas 9 and 10 in 2019. While this research targets the sub-populations of sheep in the herd most likely impacted by disease, insight may be garnered by contrasting data from the relatively better performing sheep in hunt area 8. Indeed, to fully comprehend population dynamics and the interaction among density, nutrition, disease and migration in the WMBS herd, we must capture and include animals from hunt area 8 in ongoing research to develop the ‘West Side Story’.

Objectives

The goal of the proposed research is to continue to unravel the processes underpinning the dynamics of sheep populations by maintaining a longitudinal study design and better understanding the contributions of summer nutrition, predation, disease and migration on survival of young sheep in the WMBS herd. Knowledge of limited resources or other factors affecting sheep in the Whiskey herd will be used to guide future management actions to support sustainable populations for future generations.

Specific project objectives include:

1) Determine seasonal ranges and potential migration corridors, and evaluate life history strategies for WMBS residing in hunt area 8.
2) Estimate nutritional carrying capacity of WMBS populations to assess the capacity of habitats to support sheep.
3) Assess survival and cause-specific mortality of adult female and neonate sheep.
4) Evaluate intrinsic and extrinsic factors affecting vital rates (e.g., pregnancy, seasonal survival, migratory status, recruitment of young).
5) Assess longitudinal changes associated with disease, nutrition and immunocompetence.

6) Evaluate diet, forage quality (including micronutrients) and abundance during summer.
7) Evaluate the effects of naturally occurring browsing, intense browsing, and fire on forage quality (including micronutrients) and biomass of forage on summer ranges.

Methods

To understand contributions of summer nutrition and disease to bighorn sheep lamb survival, we propose to expand ongoing research into summer diets, forage quality, survival, and cause-specific mortality of lambs in hunt areas 9 and 10 of the WMBS herd by capturing up to 20 adult (≥1 yr old) female sheep via helicopter netgunning in designated Wilderness lands managed by the Bridger Teton National Forest (BTNF) in hunt area 8. Additionally, we will capture via hand a portion of neonate lambs birthed by telemetered ewes. We will strive to maintain this sample of sheep to attain variation in habitat conditions and population densities. Radiocollars will remain on animals that survive the duration of the study (3-5 years). When mortalities occur, collars will be recovered and placed on new, unmarked animals during the following capture effort.

We will continue to recapture the same radiomarked females during both autumn and late winter to allow assessment of seasonal ranges and provide links to seasonal pulses in mortality commonly observed with pneumonia (i.e., breeding and lactation seasons). Animals will be recaptured via helicopter netgunning. We will fit each sheep with an Iridium satellite GPS collar (825g; ~1% body weight) programmed to obtain a location at least every 1 hour throughout the year. In addition, the Iridium collars will be programmed to transmit location data and status (live or in mortality) remotely via the satellite system at least every 3 days, or in the instance of a mortality, immediately. The Iridium GPS collars will be equipped with a communication Ultra High Frequency (UHF) system to allow remote monitoring of Vaginal Implant Transmitters (VITs) and lamb collars by the dam's collar. Mortalities will be recovered as quickly as possible following death in an effort to ascertain cause of death.

Helicopter netgunned sheep will be hobbled, blindfolded and slung to a staging area outside of designated Wilderness to be processed by Dr. Monteith and his UW research team. We will determine age of each female via incisor replacement patterns and horn annuli. We will measure body weight using an electronic platform scale, and assess relative size of animals using morphometric measurements. We will conduct field ultrasonography with a 5-MHz transducer to determine nutritional condition of each captured animal using standard protocols developed for bighorn sheep. During late-winter captures we will again use ultrasound and transabdominal scanning with a 3-MHz transducer to determine pregnancy status, after shaving the left-caudal abdomen. Fecal samples will be collected during capture from each individual and subsequently analyzed for cortisol levels to relate to nutritional condition and infection. Additionally, nasal, tonsil and ear swabs will be collected for microbial culture and PCR for detection of bacteria responsible for pneumonia (e.g., *Mycoplasma ovipneumoniae, Mannheimia haemolytica*). All culture and pathogen identification work will be conducted by the

Veterinary Health Laboratory of the WGFD using their standardized protocols. Processed sheep will then be slung via helicopter back to their original capture site and released.

Upon completion of ultrasonography in March, pregnant female sheep will be fitted with VITs. VITs will be sterilized in chlorhexidine solution prior to deployment and inserted using smoothed and sterilized plastic tubing and wooden dowels. Fitting pregnant animals with VITs takes <1min to complete and will be coincident with other data collection and monitoring of animals during capture. VITs will be equipped with a temperature and light-sensitive switch that will increase pulse rate when the temperature decreases below 32° C representative of the VIT being expelled by the sheep, a signal that will be received by the dam's GPS collar, activating an email indicating birth has occurred along with the animal's location.

During the beginning of the parturition season (approximately 1 June), adult females and VITs will be monitored remotely via UHF and satellite technology. Upon evidence of an expelled VIT, we will use field crews and ground-based telemetry to locate the VIT and the radiocollared female as quickly as possible. We will capture neonatal sheep by hand and place them in a cloth bag containing local vegetation to facilitate restraint and minimize scent transfer. We will determine sex of each neonate and acquire a measurement of new hoof growth using calipers, measure length of hind foot, and total body length and determine body mass. We will then fit expandable GPS collars on lambs and release them at the capture site.

Anticipated Outcomes

Respiratory disease has afflicted populations of bighorn sheep for the past century and, despite substantial research on the topic, pneumonia continues to be one of the most poorly understood diseases that afflict wildlife in North America. Our work seeks to understand how we can more effectively manage chronically infected populations of bighorn sheep. Implicit with our continued work is calibrating models of animal-indicated nutritional carrying capacity for Wyoming sheep, which will increase the toolset for managers to understand how habitat, density, and extrinsic factors such as predation or perhaps disease are regulating these and other populations. Our work to date has demonstrated that infected populations are not immune from fundamental nutritional dynamics and instead, suggests that nutrition may be a key explanatory factor, along with disease, of the disparity in performance across sheep herds in Wyoming.

Timeline

The larger bighorn sheep project encompassing the Jackson, Cody and Whiskey sheep herds began in 2015, with the goal of maintaining longitudinal data collection through at least 2025. Currently, we aim to enter the Whiskey sheep herd 'West Side Story' as outlined in the proposal herein as early as March 2021. If permission is granted to allow helicopter capture of bighorn sheep ewes in the Wilderness in the Upper Green River area of the BTNF, GPS collaring and deployment of VITs in pregnant ewes could occur in March of 2021. Lamb collaring and monitoring would occur during summers 2021–2023 and possibly 2024, with data analyses, compilation and write up occurring thereafter.

Upper Green Whiskey Sheep Project Proposed Timeline

Year	Time	Task
2021	March	Capture adult; deploy GPS collars and VITs
	Summer	Neonate capture and monitoring
	Summer	Lamb monitoring; vegetation sampling
	Autumn	Recruitment surveys
	December	Recapture adults
2022	March	Recapture adults; deploy VITs
	Summer	Neonate capture and monitoring
	Summer	Lamb monitoring; vegetation sampling
	Autumn	Recruitment surveys
	December	Recapture adults
	Ongoing	Lab and data analyses- public outreach
2022	March	Recapture adults; deploy VITs
	Summer	Neonate capture and monitoring
	Summer	Lamb monitoring; vegetation sampling
	Autumn	Recruitment surveys
	December	Recapture adults
	Ongoing	Lab and data analyses- public outreach
2024	March	Recapture adults
2024+	Ongoing	Lab and data analyses- public outreach
	Ongoing	Analyses, presentations, publications, outreach

Projected Budget:

Description	FY2021	FY2022	FY2023	FY2024	FY2025
Radiocollars					
20 Iridium satellite GPS collars @ $2400/ea.	$48,000	$0	$0	$0	$0
Satellite data fees @ $500/collar/year	$10,000	$10,000	$10,000	$10,000	$0
15 Expandable GPS lamb collars @ $700/ea.	$10,500	$10,500	$10,500	$10,500	$0
15 vaginal implant transmitters @ $275/ea.	$4,125	$4,125	$4,125	$4,125	$0
20 Rebattery GPS collars @ $400/ea.	$8,000	$8,000	$8,000	$0	$0
Sheep Captures					
Spring helicopter captures; 20 sheep @ $750/ea.	$15,000	$15,000	$15,000	$15,000	$0
Autumn helicopter captures; 20 sheep @ $750/ea.	$15,000	$15,000	$15,000	$15,000	$0
Ground captures; 15 sheep @ $100/ea.	$1,500	$1,500	$1,500	$1,500	$0
Lab Analyses					
Plant quality analyses; 35 spp., 3 rounds	$3,500	$3,500	$3,500	$3,500	$0
Fecal DNA metabarcoding; 3 rounds	$2,400	$2,400	$2,400	$2,400	$0
Necropsy, histology, culture and serology	$1,800	$1,800	$1,800	$1,800	$0
Personnel, Travel and Supplies					
Field equipment and supplies	$18,500	$14,700	$14,700	$14,700	$500
Travel expenses	$12,325	$12,325	$12,325	$12,325	$1,275
MS student	$25,200	$27,720	$30,492	$33,541	$0
Field technicians	$11,300	$11,300	$11,300	$11,300	$0
Accounting and technical support	$18,975	$11,278	$10,125	$8,765	$1,195
Publication and outreach fees	$0	$0	$0	$0	$5,000
	$206,125.00	**$149,148.00**	**$150,767.00**	**$144,456.00**	**$7,970.00**
			Total Projected Cost:		**$658,466.00**