ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
PO Box 115526
Juneau, AK 99811-5526

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Project Title: Ewe Dall's sheep survival, pregnancy and parturition rates, and lamb recruitment in GMU 13D, Chugach Mountains, Alaska

Project Duration: July 1, 2009 – June 30, 2014

Report Period: July 1, 2013 – June 30, 2014

Report Due Date: September 1, 2014

PRINCIPAL INVESTIGATORS: Tom Lohuis, ADF&G

WORK LOCATION: Central Chugach Range, GMU 13D

I. PROBLEM OR NEED THAT PROMPTED THIS RESEARCH

Dall's sheep (Ovis dalli dalli) populations fluctuate. Periodic die-offs and rebounds are well documented (Murie 1944; Murphy and Whitten 1976; Whitten 1997). 28-35% increases and decreases in sheep numbers have been reported over 1-3 year periods in some areas in the Alaska Range (Arthur 2003) and in Canada (Hoefs and Bayer 1983).

However, aerial trend surveys as well as anecdotal evidence suggest that sheep populations in Southcentral Alaska appear to have been experiencing a continual decline since approximately 1990 (ADF&G, 2007 sheep management reports). Definitive cause and effect relationships generating this decline have not been established.

II. REVIEW OF PRIOR RESEARCH AND STUDIES IN PROGRESS ON THE PROBLEM OR NEED

Sheep population declines have been linked to weather patterns, disease, predation, population density, and nutrition. However, most of the initial research on Dall's sheep populations was conducted prior to the advent of reliable, inexpensive VHF radio collar technology. In the early days, investigators relied upon data obtained during observations of sheep at mineral licks (e.g. Heimer and Watson 1986), or through multiple survey flights and ground observations without benefit of marked individuals (e.g. Nichols 1978, Murphy et al. 1990). While these survey flights provided demographic information in the form of ratios of lambs:100 ewes or of the ratio of rams:100 ewes in a given population, they did not allow investigators to definitively determine the underlying cause(s) of those ratios.

Further, observations at mineral lick sites provide opportunity for long-term monitoring but population-level conclusions drawn from these observations must be interpreted with caution (Heimer and Watson 1986 p.29). Neonate mortality between

birth and appearance at the observation site may affect conclusions about individual ewe reproductive performance.

Two more recent studies utilizing radio collared animals and investigating the rates and causes of ewe and lamb mortality in the Alaska Range showed that pregnancy and parturition rates tended to be high, ranging from 74-91 % and 44-76%, respectively, but that neonate lamb survival was typically low, ranging between 12-36% annually, with predation accounting for greater than 90% of lamb deaths (Scotton 1998; Arthur 2003). Adult animals tended to show high survival, with annual survival rates averaging 86% over several years of study, again with predation being the primary proximate cause of mortality.

However, data collected in interior mountain ranges may not be directly applicable to ranges in southcentral AK, as predator numbers, density, and behavior, as well as weather patterns, exposure to disease, habitat quality, and other influences may well be different between mountain ranges.

III. APPROACHES USED AND FINDINGS RELATED TO THE OBJECTIVES AND TO PROBLEM OR NEED

In order to identify potential limiting factors that affect this sheep population, it is necessary to measure pregnancy, natality, and parturition rates, and enumerate the rates and causes of adult and lamb mortality. It is also critical that this population be screened for the presence of diseases that may have individual or population-level impact.

To do so, 37 adult ewes were captured via helicopter net gunning and radio collared in March 2009 to initiate this project. 33/37 survived until March 2010, at which point they were recaptured. Four additional animals were captured and radio collared to maintain sample size.

At capture, we collected a blood sample to determine pregnancy status and to screen for exposure to viral diseases, a fecal sample to measure parasite load, and a nasal and pharyngeal swab for bacterial culture to determine if these sheep were carrying bacterial known to cause pneumonia in other wild sheep populations.

Surviving ewes from this cohort will be captured annually for at least two more years, and animals will be captured to replace any adult mortalities that may occur, to establish a dataset on pregnancy rates and lifetime reproductive performance.

During May and June, pregnant ewes are monitored from fixed wing aircraft. When detected, neonate lambs are captured and radio collared, and then ewes and lambs will be monitored regularly to determine the timing of mortality. When mortalities are detected, they are investigated as soon as possible to attempt to determine cause.

IV. MANAGEMENT IMPLICATIONS

Managers will benefit from accurate estimates of demographic parameters. The first priority is to further our understanding of baseline demographics including survival, pregnancy, natality, and recruitment rates. At the same time, the influences shaping sheep population trends need to be elucidated. These influences include but are not limited to weather, predation, disease, habitat and nutrition, and human action. Finally, a research program must be designed to develop techniques and compile baseline data sets that will facilitate future research to advance the scientific knowledge base on Alaskan Dall Sheep while simultaneously providing the best possible information with which to manage sheep populations.

V. SUMMARY OF WORK COMPLETED ON JOBS FOR LAST SEGMENT PERIOD ONLY

JOB/ACTIVITY 1: Pregnancy, parturition, and recruitment rates; Timing and cause of mortality.

Accomplishments:

Captures, Sample composition, Pregnancy rates: 37 adult (4 years old or older) ewes were captured in March 2009 to initiate this project. 22/34 (65%) of these ewes were pregnant in 2009. 33 adult ewes survived to March 2010, and 30 of those 33, along with 4 additional, adult ewes, were captured and tested for pregnancy. 88% (30/34) of ewes were pregnant in 2010.

Of the 37 ewes that comprised the sample population after captures in March 2010, 32 survived to March 2011. In October 2010, we captured and radiocollared the five surviving female "lambs" which had been born in May and June 2009 (17 months old at that point) in an effort to determine age of first reproduction in this population.

We captured 34 of those 37 previously collared ewes, as well as six additional ewes, in March 2011. After captures in March 2011, we had a sample of 42 collared ewes.

20/30 (66%) adult (4 years old or older) were pregnant in 2011, while none of the 9 ewes aged two or three were pregnant. From this limited sample, it appears that ewes in this population probably first breed in the fall of their third year, and subsequently give birth at age four. Three ewes were not captured and therefore, not tested.

During the FY 2012 reporting period, 36/42 ewes survived. 34 of those ewes were 4 years old or older. 31 of those 34 were recaptured in March and April of 2012. 6/31 were pregnant, for a 19% pregnancy rate among adult ewes. It is of interest that this author has not heard of a lower pregnancy rate in an ungulate population.

During the FY 13 reporting period, two of 36 ewes died, one lost to an unknown nonpredation cause in January 2013 and one killed in an avalanche in February 2013. The radio collar failed on an additional ewe and she was removed from the study sample despite being observed on several occasions. Out of the remaining 33 radiocollared ewes, we recaptured 26 in March and April 2013. 22/26 were pregnant for an 84.6% pregnancy rate.

33 ewes were alive at the beginning of the FY 2014 reporting period. 29/33 survived, three killed in avalanches and one dying of malnutrition. Of the 29 survivors, we recaptured 17 and removed their collars in March 2014. 3/17 (18%) were pregnant when their collars were removed. 11 animals remain alive and on the air in the 13D study area.

Parturition rates: In 2009, 19/22 (86%) of pregnant ewes were observed with a viable lamb, with one additional stillborn lamb observed. In 2010, 25/30 (83%) of pregnant ewes were observed with a viable lamb. In 2011, 20/20 (100%) pregnant ewes were observed with a viable lamb. During the FY 2012 reporting period, 4/6 known pregnant ewes were observed with a lamb for a 66% parturition rate.

During the 2013 reporting period, we observed 17/22(77%) of pregnant ewes with a viable lamb.

Ewes were not flown during the 2014 lambing season.

Recruitment rates: In 2009, 24 neonate lambs were radiocollared. 3 lambs shed their collars and were excluded from analysis. 2 additional lambs were killed by eagles after being handled and prior to reunification with the ewe, and were also excluded from analysis. 9/19 (47%) lambs survived through May 2010. Female lambs in this cohort were captured and radiocollared in October 2010 and added to the study group to provide known-age animals to determine age at first reproduction and measure mortality during their second winter. Male lambs were captured and their collars removed.

In 2010, 26 neonate lambs were radiocollared. 4 lambs shed their collars and were excluded from analysis. Two other radiocollars malfunctioned and those animals were also eliminated. Two of the 20 (10%) survived through May 2011; we continue to monitor these sheep.

In 2011, 32 neonate lambs were radiocollared. Stitching issues resulting in the loss of 6 collars. Those animals have been removed from analysis. 4 of the remaining 26 lambs survived for a 15% survival rate.

In 2012, 11 lambs were radiocollared and included in analysis. 8/11 survived through May 2013 for a 73% survival rate.

In 2013, 26 lambs were radiocollared. One collar dropped, and one lamb was mistakenly removed from the data sheet and not checked for several months. As a result, the 2013-2014 sample was comprised of 24 animals. 12/24 survived for a 50% survival rate.

Lambs were not captured during the spring of 2014.

Rates, causes, and timing of mortality

Adult mortality:

33/37 (81%) of ewes initially captured in March 2009 were still alive in March 2010. Deaths occurred in March 2009 (unknown cause, possibly capture related); March 2009 (wolverine predation), April 2009 (avalanche), and March 2010 (avalanche).

Of 37 ewes alive after captures in March 2010, nine died between April 15, 2010 and March 15 2011.

Two deaths occurred in May 2010, one caused by a systemic infection related to an aborted fetus and retained placenta and the second as a result of pneumonia. Pathology laboratory results indicate the presence of Mannhemia and Pasturella bacteria in the respiratory tract of the animal that died from pneumonia.

A third death occurred in August 2010 and was also the result of pneumonia. Pathology laboratory reports were inconclusive on this case, potentially as a result of the delay between the mortality itself and recovery of that mortality—three to four days in warm temperatures.

Deaths four and five of radiocollared ewes occurred in February 2011. One adult ewe died in a slab avalanche, and wolves killed another.

Animals six through eight also occurred in March, 2011: A wolverine killed one animal, a 16-year old ewe died of nonpredation causes, and one animal died during capture when she slid 1000' down an avalanche chute.

The ninth and final animal was lost to pneumonia in May of 2011. Pathology results are pending on this animal.

During the 2012 reporting period, three adult sheep died. Two were killed in avalanches, while one died of pneumonia.

During the 2013 reporting period, two adult ewes died. One was lost to an unknown nonpredation cause, while the other was avalanched.
During the 2014 reporting period, four adult ewes dies. Three were killed in avalanches, and one died of malnutrition.

Lamb mortality:

Of the 2009 cohort of 24 lambs, five were eliminated from analysis as described above. Of 19 lambs included in analysis, 10 deaths were recorded. Six deaths occurred in May and June 2009 (2 eagle predation, 1 brown bear predation, 1 unknown predator, 1 drowning, and 1 starvation as the ewe apparently failed to lactate.) Three deaths occurred during winter 2009-2010 and were caused by malnutrition (December 2009), Malnutrition (January 2010), and wolf predation (February 2010).

Of the 2010 cohort of 26 lambs, 6 animals were eliminated from analysis as described above. Of the 20 animals included in analysis, 18 died before reaching one year of age. Three deaths occurred in May 2010 (Fall, drowning, and starvation due to the ewe failing to lactate). Three deaths occurred in June 2010 (Eagle predation, drowning, and one to an unknown cause.

One lamb died in August 2010 as a result of pneumonia. Pathology laboratory results show the presence of Mannheimia bacteria in the respiratory tract of this animal.

Four lambs died in October and November of 2010, all to predators. Three were lost to brown bears, while the carcass of the remaining one was visited by wolves, coyotes, and lynx.

Two lambs were killed by wolverines, and one killed by an unknown predator in February and March of 2011, and three others were killed in avalanches between March and May 2011. A final lamb was killed by a brown bear in early May 2011.

Of the 2011 cohort of 32 lambs, six were excluded from analysis as described above. 22 of the remaining 26 died during their first year of life. 4/26 or 15% survived to one year of age. Predation accounted for 10/26, or 38%, and nonpredation losses took 7/26 or 27%. The remaining 3 lambs were not recovered at the time of death due to extreme avalanche danger and as a result of the delay a definitive cause of death could not be determined.

Lamb deaths caused by predators are detailed as follows. Three were lost to eagle predation, two in May 2011 and one in June; one to a black bear in May 2011, one to an unknown predator in June 2011 (dents in the collar suggest wolverine predation, but no tracks or scat could be found at the site to confirm this). Wolverines were confirmed as the cause of death of three other lambs during winter 2011-2012. One lamb was killed by a coyote in December 2011, and one lamb was killed by predators in Feb 2012, but a definitive cause of death could not be established in this case as both wolves and wolverines had visited the kill site.

Nonpredation losses were caused by several factors. Rockslides killed one lamb each in May and June 2011. One lamb died of severe contagious ecthyma in July 2011. Winter losses were higher, and include two others that died of malnutrition in January 2012. Two more were killed in avalanches, in February and March 2012.

Extremely low pregnancy rates resulted in a smaller than usual sample of lambs captured during the 2012 reporting period. Of 14 lambs captured during May and June 2012, one was abandonded by the ewe immediately after capture. It was recovered via helicopter and transported to the Alaska Zoo. Of the remaining 13, two dropped their collars and were excluded from analysis. Three of the eleven were killed in the reporting period. One was killed by an eagle shortly after birth in June of 2012. Two others were noted as having died between February 22 and March 19 2013. One was located in an avalanche debris pile, but the other could not be recovered due to high avalanche danger at the mortality site.

We captured a cohort of 26 lambs in May and June 2013 to comprise the final sample of lambs for this project. One lamb dropped its collar shortly after handling and was eliminated from analysis. One additional lamb was mistakenly dropped from the data sheet and not checked for several months, and was removed from analysis, leaving a sample of 24 lambs.

Three were killed by eagles on May 24, 25, and 29, One slid into a moat between an icefield and the surrounding rock and was observed dead on May 30. A lamb fell to its death on May 31.

Two lambs were lost to predation in July 2013, one to an eagle and one to a wolverine. One additional lamb was killed by a predator, likely a wolverine, in March 2014, and three others were killed in avalanches in late winter (March – May) 2014. One lamb carcass could not be reached due to high avalanche danger and is classified as 'unknown'

JOB/ACTIVITY 2: Animal health profile

Accomplishments: After the 2009 capture session, blood sera from 34 adult ewes was tested for exposure to viral diseases known to affect sheep populations. Samples from the additional four animals captured in 2010 were also tested. Samples were screened for titers to Parainfluenza-3, malignant Catarrhal fever, Bovine viral diarrhea, Episodic hemmorhagic disease, Ovine progressive pneumonia, Respiratory syncitial virus, and infectious bovine rhinotrachieitis. No exposure was detected to any of these diseases.

Nasal and pharangeal swabs from 37 animals captured in 2009 were sent to the Washington Animal Disease Diagnostic laboratory and cultured to ascertain if these

animals carried bacteria associated with respiratory disease and pneumonia in other wild sheep populations. 19/37 animals tested positive for bacteria of the genus Pasturella, and 9/37 were positive for bacteria of the species Mannheimia hemolytica. Work is ongoing to determine how pathogenic these bacteria are and what effect they might be having on the study population.

Blood sera from 34 adult ewes was collected at initial capture in March 2009, and from 4 additional animals captured in 2010. A portion of this sample was sent to the University of Wyoming veterinary laboratory for analysis of trace mineral levels and amino acid profiles, and a portion was sent to Providence Hospital in Anchorage for blood chemistry and metabolic panel analysis. This data is currently being analyzed and compiled.

This job was not active during the current reporting period in this study area

JOB/ACTIVITY 3: Assess weather effects

Accomplishments: Six temperature dataloggers were deployed in the study area in fall, 2009. These dataloggers record the temperature at one-hour intervals for a two year period. They will allow us to determine whether freeze-thaw (chinook) events are causing ice layers to form on snow in sheep winter range, which could increase the availability of winter forage. We are also relying on NOAA's Remote Automated Weather Stations (RAWS network) to collect snowfall data at two points adjacent to the study area.

We recovered these dataloggers in May and June of 2011 during lamb capture work. This data is currently being downloaded and analyzed. This job was not active during the current reporting period in this study area.

JOB/ACTIVITY 4: Data analysis and report writing

Accomplishments: Data analysis is underway with a view to preparing manuscripts for publication in peer-reviewed scientific journals.

VI. LITERATURE CITED

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VII. PUBLICATIONS:

At this time, we have not collected sufficient data to submit manuscripts for peer-reviewed scientific journals. However, the PI (Lohuis) presented research updates to several scientific and popular audiences during the reporting period. These presentations are detailed as follows:

Oral presentations:

Dall's sheep research in the Chugach Range, Alaska. April 2009. Safari Club International, Anchorage Chapter.

Dall's sheep productivity and Survival in the Chugach Range, GMU 13D, Alaska. February 2010: Special session for arctic and alpine ungulates, Alaska Chapter of The Wildlife Society. Anchorage AK.

Dall's sheep productivity and Survival in the Chugach Range, GMU 13D, Alaska. June 2010: Northern Wild Sheep and Goat Council, Hood River, OR.

Poster Presentation:
Dall's Sheep research in Alaska. February 2010. The Wild Sheep Foundation annual convention, Reno, NV.

I. ADDITIONAL FEDERAL AID-FUNDED WORK NOT DESCRIBED ABOVE THAT WAS ACCOMPLISHED ON THIS PROJECT DURING THIS SEGMENT PERIOD

None

II. RECOMMENDATIONS FOR THIS PROJECT

Continue capture and monitoring operations for a minimum of two more years.

Prepared by:
Tom Lohuis, WB III

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