Dall’s sheep research in the Chugach Range, GMUs 13D and 14C

Tom Lohuis, Alaska Department of Fish and Game, Anchorage, AK
Study area background and goals

13D – Declining sheep population

Study area guesstimates

\[ \approx 650-750 \quad 1960s \text{ through } 1980s \]
\[ \approx 350-430 \quad 2007 \text{ and } 2009 \]

- Until 2005, declines approximately equal in ram and ewe component

Project goals: Establish a baseline demographic picture...“What is driving sheep population trends in southcentral Alaska?“

Pregnancy, recruitment, rates and causes of mortality, disease
GMU 13D, between Taslina Lake and Matanuska Glacier
Study area background and goals

14C – Cyclic sheep population

GMU-wide guesstimates

≈900-1100  1970s through early 1980s
≈2000-2100  late 1980s through 2000
≈900-1000  2007 through 2011
≈1000-1100  2014 and 2015

Trajectory similar in ram and ewe component

Primary project goals: 1) Are the driving factors similar between the northern and southern Chugach? 2) Can we generalize between study areas?

Secondary project goals: What are the rates and causes of mortality in 3-8 year old rams?
Species Background

Weather
- Late, heavy spring snows
- Ice formation

Predation
- AK range studies (Arthur 2003 and Scotton 1998)
  - ≈ 90% of lamb mortality due to predation
  - coyotes 47%, eagles 30%
  - 100% adult mortality caused by predation
  - wolves 57%, bears 7%, wolverines 7%

Lamb survival to 1 yr = 22%
Annual adult survival = 85%
Species Background

Habitat and nutrition

- Mineral deficiencies
- Malnutrition

Disease

- Pneumonia or other disease
- Reports of dead sheep in both study areas from hunters and during annual surveys
Captures and handling

GMU 13D ≈ 40 adult ewes captured/recaptured annually, March 2009-2014

GMU 14C - 35 adult ewes captured/recaptured annually, March 2012-2016, 19 juvenile rams captured and monitored 2012-2016

VHF/ GPS radiocollar, blood, fecal samples, nasal and pharyngeal swabs, qualitative body condition assessment, pregnancy test
Captures and handling

Extremely stressful event for animal

- Limit helicopter chase time
- Slow them down before netting
- Monitor body temperature
- Limit handling time
Results
Nutritional condition

Body condition appeared extremely poor, even for late winter (1-2 on a 0-5 scale)

14C ewes slightly better than 13D

No subcutaneous (SQ) fat present

All bony structures of neck, spine, withers, pelvis evident (0.5-1.0 cm between spine and muscle)

S. Arthur (ADF&G, Fairbanks) reports ewes captured in Brooks and AK ranges all carry SQ fat and are well-muscled
Pregnancy rates

Typically 85-100% (AK Range, Arthur 2003; BC Stone’s Sheep - Wood et al 2012)

<table>
<thead>
<tr>
<th>Year</th>
<th>GMU 13D</th>
<th>GMU 14C</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>62%</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>88%</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>69%</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>21%*</td>
<td>44%</td>
</tr>
<tr>
<td>2013</td>
<td>85%</td>
<td>94%</td>
</tr>
<tr>
<td>2014</td>
<td>18%**</td>
<td>91%</td>
</tr>
<tr>
<td>2015</td>
<td></td>
<td>96%</td>
</tr>
<tr>
<td>2016</td>
<td></td>
<td>72%</td>
</tr>
</tbody>
</table>
Disease

Swabs cultured for bacteriology; blood samples for serology

50% - 60% positive for bacteria thought to be endemic to wild sheep herds in L48 and AK

No evidence of Mycoplasma ovipneumoniae

Extremely small number of animals positive for exposure to viral diseases, parasites
Monitoring – Adult sheep

Flights 2x/mo. Check animal, record location

Radio telemetry – Collar emits 60 bpm as long as animal is alive

Mortality mode (4 hrs adults, 1 hr lambs) 90 bpm

When a mortality signal is detected, we investigate as quickly as possible.
Adult Mortality
Adult Mortality
Adult Mortality
Ewe mortality

GMU 14C
17 mortalities 3/2012-Present
134 sheep-years of data
≈13.0 % adult mortality/year

GMU 13D
183 sheep – years of data
≈13.0 % adult mortality/year
Ewe mortality – GMU 14C
134 sheep-years of data, 17 deaths

- Survived: 87%
- Avalanche: 6%
- Wolverine: 1.5%
- Brown Bear: 0.75%
- Unk pred: 2.5%
- Birth: Unknown

Note: Percentages rounded for clarity
Ewe mortality – GMU 13D
183 sheep-years of data, 24 deaths

- Survived: 87%
- Avalanche: 2%
- Pneumonia: 1%
- Wolverine: .5%
- Wolf: .5%
- Unk pred: 1%
- Uterine infection: 6%
- Age: Unknown

Note: Percentages rounded for clarity
Lamb Captures - May 15-June 15
Monitoring Schedule

Daily flights May 15 - June 15 to determine parturition, locate lambs for capture, and check for mortality of collared lambs

June 15 – July 1  flights 2x/week.
July 1 – Aug 10   flights 1x/week.
After Oct. 1      flights 2x/mo.

When a mortality is detected via radio signal, we investigate as soon as possible
# Lamb survival rates

<table>
<thead>
<tr>
<th>Year</th>
<th>GMU 13D</th>
<th>GMU 14C</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>42%</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>64%*</td>
<td>66%</td>
</tr>
<tr>
<td>2013</td>
<td>50%</td>
<td>64%*</td>
</tr>
<tr>
<td>2014</td>
<td></td>
<td>42%</td>
</tr>
</tbody>
</table>

* Small sample size
Fate of newborn lambs

GMU 14C
- Survived: 57%
- Predation: 28%
- Nonpredation: 9%
- Unknown: 6%

GMU 13D
- Survived: 32%
- Predation: 31%
- Nonpredation: 6%
- Unknown: 31%

Note: Percentages rounded for clarity
Lamb fates – GMU 14C
2012-2014, n=54

Survived: 57%
Eagle: 15%
Coyote: 4%
Wolverine: 3%
Brown Bear: 2%
Unk Pred: 2%
Fall: 6%
Avalanche: 15%
Drowning: 3%
Unk Nonpred: 2%
Unknown: 57%

Note: Percentages rounded for clarity
Lamb fates – GMU 13D
2009-2013, n=101

Survived: 32%
Eagle: 11%
Brown Bear: 6%
Wolverine: 6%
Unk Pred: 3%
Mult Pred: 6%
Wolf: 2%
Coyote: 1%
Black Bear: 10%
Avalanche: 4%
Winter Starvation: 3%
Drowning: 3%
Unk Nonpred: 3%
Fall: 2%
Rockslide: 1%
Neonate Starvation: 6%
Pneumonia/disease: 6%
Unknown: 6%

Note: Percentages rounded for clarity
Summary – Adult survival

Annual adult survival rate both subunits ≈ 87%

- Brooks 2009-2011 = 77-88% (Arthur 2012)

17% (13D) and 24% (14C) adult mortality due to predation

- AK range 1999-2003 = 100% adult mortality to predation
- Brooks 2009-2011 = 100% adult mortality to predation

(Arthur 2003; Arthur 2012)
Lamb survival - GMU 13D

Lamb survival to 1 year 2009-2013 ≈ 42, 9, 15, 64, 50% respectively (36% average)

- Brooks 2009-2011 = 68, 48, 28% (Arthur 2012)

50% of lamb mortality due to predation (31/62 diagnosed lamb deaths caused by predators)

- AK range 1999-2003 = 90% (Arthur 2012)
- Brooks 2009-2011 = 72% (Arthur 2012)
Lamb survival - GMU 14C

Lamb survival to 1 year 2012-2014 ≈ 66, 64, 42%
(57% average)

AK range 1999-2003 = 12, 23, 16, 36% (Arthur 2003)
Brooks 2009-2011 = 68, 48, 28% (Arthur 2012)

Although 75% of lamb mortality due to predation (15/20 diagnosed lamb deaths caused by predators), survival is high and only 1 in 3 lambs that are born are killed by predators

AK range 1999-2003 = 90% (Arthur 2012)
Brooks 2009-2011 = 72% (Arthur 2012)
Survived: 57%
Predation: 9%
Nonpredation: 28%
Unknown: 6%

Survived: 31%
Predation: 31%
Nonpredation: 6%
Unknown: 32%

Survived: 48%
Predation: 13%
Nonpredation: 37%
Unknown: 2%

Survived: 66%
Predation: 8%
Nonpredation: 22%
Unknown: 22%

Conclusions

Predation – Accounts for less Chugach sheep than in other ranges. ≈ 1/4-6 adults, 1/3 lambs.

In 14C, 3/4 lamb deaths are due to predation but overall lamb survival very good

Low percentage, and broad distribution across predator species suggests populations are not predation limited
Conclusions

Disease -

Low level presence/prevalence of major wildlife diseases; no population-level effects

Some animals succumb to pneumonia (additional stressors?) but overall, disease not a major factor

No evidence of Mycoplasma ovipenumoniae
13D - Annual pregnancy rates of 62%, 88%, 66%, 21%, 91%, and 18%.

14C - Annual pregnancy rates of 44%, 91%, 94%, 96%, 72%.

Low and variable compared to other thinhorn sheep populations
Conclusions

Low and/or variable pregnancy rates coupled with poor body condition strongly suggests nutrition/habitat/weather issue

Population appears close to carrying capacity
Current Research Questions

How do long term weather patterns affect sheep and/or habitat?

Can we estimate carrying capacity?

How many sheep should we expect the range to support?

- Estimate amount of habitat
- Estimate nutrition available in that habitat
Current Research Questions

Is summer or winter habitat limiting?
  Summer plant growth and protein
  Winter snowpack, temperature, avalanches

How do vegetation community changes and tree/shrub advance (Dial et al 2007) affect sheep populations?
  Have we lost sheep habitat?
  Does the nutritional content of sheep browse change as a function of summer weather?
Current Research Questions

Remote sensing/historical imagery to determine extent of historic habitat (Tom Day MS research, APU)

Maintain ~30 GPS collared animals to determine current habitat use (Kyle Smith MS research, APU)

Current – historical = estimate of habitat loss

Observational work to determine diet items and nutritional content (Luke Metherell BSc research, UAA)

Continue with annual captures and monitoring - body condition, pregnancy, mortalities
Additional research topics

Life history of rams?
  Mortality patterns appear similar to ewes
  Additional hunting opportunity?

Movement and dispersal
  Horn growth, annuli formation

Sightability
  Improve reliability, consistency of counts
  How many do we see vs how many are there?
North Wrangell Mountains project

Initiated Fall 2016
Focus on 3-6 year old rams, 40 GPS collars deployed

Nabesna Glacier to Sanford Glacier

Distributed between hard park and preserve

Density, weather, habitat similar between park and preserve
North Wrangell Mountains project
Research Goals

Baseline information on ram populations
Rates and causes of mortality, disease screen

Home range, movement, dispersal
Do management area boundaries accurately reflect sheep movement and home ranges?
North Wrangell Mountains project
Research Goals

Test dominance related mortality hypothesis –

Hard park – Hunted under subsistence, any ram
1/3 harvest mature rams, 1/3 4-6 y.o., 1/3 ≤ 4 y.o.

Preserve – Hunted under full curl
All harvest mature rams

Harvest similar proportion of population in hard park and preserve
Dominance related mortality hypothesis
(Geist 1971)

Male survival lower due to participation in rut

Heavy harvest of large rams increases the mortality of younger rams with increased rutting behavior
North Wrangell Mountains project
Research Goals

Measure energy expenditure during the rut and compare hard park to preserve

Pre- and post-rut capture
weights, measure fat and protein with ultrasound, triaxial accelerometer “fitbit”
Mike Harrington, Becky Schwanke, Tony Kavalok, Thomas McDonough, Chris Brockman, Gino Del Frate, Kyle Smith, Cory Stantorf, Brianne Boan, Wade Schock, Dave Battle, Todd Rinaldi, Tim Peltier

Mike Meekin, Mike Litzen, Matt Keller, Mark Shelton, David Rivers, Tommy Levanger, Chris Jordan, Troy Cambier, Joe Fieldman, Brandon Silvie, Chris Ramsey, Harley McMahon

Thanks!