Correlating Respiratory Pathogens and Demographic Attributes: A Collaborative Effort

BIGHORN RECOVERY

Bighorn Sheep Population

Before 1800  Current
RESPIRATORY DISEASE

Perhaps the most important factor limiting recovery of bighorn populations

Montana Fish Wildlife and Parks
PATHOGEN TESTING
PATHOGEN TESTING

Leukotoxin
- Mannheimia haemolytica
- Bibersteinia trehalosi

Mycoplasma ovipneumoniae
PATHOGEN TESTING

Prevalence %

- M. haemolytica
- B. trehalosi
- Leukotoxin

Movi
M. haemolytica
B. trehalosi
Leukotoxin
MANAGEMENT OPTIONS

Vaccinate
Prevent Commingling
Eradicate Pathogens
Limit Population Size
MANAGEMENT OPTIONS

Limit Population Size

Persistence of Different-sized Populations: An Empirical Assessment of Rapid Extinctions in Bighorn Sheep

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Evaluating apparent competition in limiting the recovery of an endangered ungulate

Heather E. Johnson · Mark Hebblewhite ·
Thomas R. Stephenson · David W. German ·
Becky M. Pierce · Vernon C. Bleich

OIKOS 96: 389–401, 2002

Allee effects in stochastic populations

Brian Dennis

IMPORTANCE OF GENETIC VARIATION TO THE VIABILITY OF MAMMALIAN POPULATIONS

ROBERT C. LACY

Department of Conservation Biology, Daniel F. and Ada L. Rice Center, Brookfield Zoo, Brookfield, IL 60513
Learn to Minimize Effects of Disease
There are bighorn populations that host the respiratory pathogens and are demographically robust.
STUDY PLAN

Sample Diverse Populations
STUDY PLAN

1. Sample Diverse Populations
2. Test for Pathogens
3. Determine Pathogen Communities
STUDY PLAN

Sample Diverse Populations

Test for Pathogens

Determine Pathogen Communities

Relate to Demographics
Sample bighorn populations displaying range of herd attributes:

Native vs. Restored
Climate
Population Connectivity

Migratory Patterns
Population Size
Disease History

Movi

Nasal Swab
PCR
IGS Strain Typing
Exposure, Presence & Prevalence

Serum
ELISA Antibody

Pasteurellaceae
Tonsil Swab
Culture
Species PCR
Leukotoxin PCR
Presence & Prevalence

Detected Pathogen Community in Host Population at Time T

Ewe Survival
Pregnancy
Recruitment
Population Growth
Sample bighorn populations displaying range of herd attributes:

<table>
<thead>
<tr>
<th>Native vs. Restored</th>
<th>Migratory Patterns</th>
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<td>Population Size</td>
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<tr>
<td>Population Connectivity</td>
<td>Disease History</td>
</tr>
</tbody>
</table>
Montana Study Populations

- 124-Paradise
- 422-Castle Reef
- 213-Lost Creek
- 340-Highlands
- 302-Hilgard
- 482-Fergus
- 500a-Stillwater
Sample bighorn populations displaying range of herd attributes:

- Native vs. Restored
- Climate
- Population Connectivity
- Migratory Patterns
- Population Size

Detected Pathogen Community in Host Population at Time T

**Movi**
- Nasal Swab
- PCR
- IGS Strain Typing
- Exposure, Presence & Prevalence

**Pasteurellaceae**
- Tonsil Swab
- Culture
- Species PCR
- Leukotoxin PCR
- Presence & Prevalence
Sample bighorn populations displaying range of herd attributes:

- Native vs. Restored
- Climate
- Population Connectivity
- Migratory Patterns
- Population Size

Detection methods:

- Movi Pasteurellaceae
- Ewe Nasal Swab
- Serum PCR
- Tonsil Swab ELISA Antibody
- IGS Strain Typing
- Culture
- Species PCR
- Leukotoxin PCR

Exposure, presence, and prevalence detected pathogen community in host population at time $T$.

- Ewe Survival
- Pregnancy
- Fall Recruitment
- Population Growth
## HEALTHY VS. UNHEALTHY

<table>
<thead>
<tr>
<th></th>
<th>Healthy</th>
<th>Unhealthy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ewe Survival</td>
<td>&gt;80%</td>
<td>&lt;70%</td>
</tr>
<tr>
<td>Fall Recruitment</td>
<td>&gt;25%</td>
<td>&lt;20%</td>
</tr>
</tbody>
</table>
STARVATION
LAMB MORTALITY RATE

STARVATION
Lamb Mortality Rate

- Post-Lambing Recruitment
- Late-Fall Recruitment
- Pre-Lambing Recruitment

Mechanisms:
- Pneumonia
- Predation
- Starvation
SUMMARY

1. Sample Diverse Populations
2. Test for Pathogens
3. Determine Pathogen Communities
4. Relate to Demographics
Acknowledgements

All who have contributed to bighorn conservation

Pathogen Sampling
Keri Carson– Montana Fish, Wildlife & Parks
Jessica Jennings-Gaines – Wyoming Game & Fish
Halcyon Killion – Wyoming Game & Fish
Mary Wood – Wyoming Game & Fish

Critiques
Kelly Proffitt– Montana Fish, Wildlife & Parks
Tom Besser– Washington State University
THANK-YOU