

Respiratory Disease in Bighorn Sheep: Knowledge Gaps and Future Research

Organizing Committee

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Workshop Web Links

Abstracts and Presentations from the UC Davis Workshop can be found at:

<http://www.aawv.net/>

And

<http://www.mwvcrc.org/content/view/100/1/>



Credits

Elena Garde

Review of Davis Workshop
presented at Tucson Workshop



U. C. Davis

April 25-26, 2007

- Sponsors
 - California Dept. of Fish and Game
 - FNAWS – National
 - California FNAWS
 - UC Davis Wildlife Health Center
- Professionally facilitated
 - North Country Resources



Purpose

- Inform Wildlife and Domestic Livestock Health Specialists – Biologists, Veterinarians and Laboratory Researchers
- Technical Workshop – Science Issues
- A “free market” environment for ideas



Workshop Objectives

- To promote and foster interdisciplinary consultation and collaboration among laboratory researchers, diagnosticians, and disease specialists
- To provide an overview of recent and ongoing research on respiratory disease in domestic ruminants and wild sheep
- To identify knowledge gaps and future research needs and provide recommendations for research priorities to funding organizations



Workshop

- Pre-work – Scientific papers reviewed by participants in weeks prior to workshop
- Day 1: formal presentations on bighorn sheep ecology and current research on respiratory disease in domestic livestock and wild sheep
- Day 2: Break up into 4 working groups to address previously determined issues pertaining to respiratory disease in wild sheep



Work Group A: The Ultimate Study

Objectives

- Identify the critical unknowns and obstacles that prevent consensus on the diseases acquired from DS on BHS
- Discuss methods of overcoming these obstacles through robust study design in the natural setting



Group B: Ecological Investigation of Causes of Pneumonia Outbreaks in Bighorn Sheep

- Objectives:
 - To identify and prioritize field experiments to test hypotheses about the causes of pneumonia in free-ranging BHS to guide future research



Group C: Disease Outbreak Investigation

Objectives

- Develop a disease outbreak diagnostic protocol to provide conclusive evidence of pathogen transmission
- Discuss pros and cons of current diagnostic practices and tools
- Identify research needs to advance diagnostic capability



Group D: Disease Risks Facing Wild Sheep

Objectives

- Provide an overview of disease risks and their consequences
- Discuss risk, relative risk, qualitative and quantitative risk assessments and their limitations
- Discuss risk management options for BHS



Fundamental Concepts

- Mountain sheep social behavior and ecology play a major role in the potentially catastrophic consequences of respiratory disease
- Pasteurellosis does not tell the entire story of respiratory disease in wild sheep.
- Bighorn sheep are fundamentally different from DS in their susceptibility to respiratory disease.
- Science informs management
- Problem Focused Wildlife Management



Concept 1

- Mountain sheep social behavior and ecology play a major role in potentially catastrophic consequences of respiratory disease



Vern Bleich

California Department of Fish and Game

Ecology of Mountain Sheep:
Ramifications for Disease
Transmission and Population
Persistence



Ecology of Mountain Sheep

- Included to provide context for laboratory diagnosticians and researchers
- Enhance understanding of potential for catastrophic population losses from isolated contact with infected DS or BS



Ecology of Mountain Sheep

- Natural History Influences Risk of Disease Transfer
 - Male reproductive strategies lead to greater ram movements to enhance reproductive opportunities
 - Attraction to DS and other BS and behavior facilitates transmission of disease agents
 - Increases risk of catastrophic disease outbreaks



Concept 2

- Pasteurellosis does not tell the entire story of respiratory disease in wild sheep.
 - Has important ramifications for outbreak investigation, diagnosis, and “treatment”



Glen Weiser

University of Idaho

Pasteurellaceae and Other
Microorganisms Involved in
Respiratory Disease



Glen Weiser

University of Idaho

- *Pasteurella* and *Mannheimia*, implicated as a cause of respiratory disease but are not the complete answer to the questions of disease outbreaks in bighorn sheep
- Many types of both species are found in both healthy and diseased animals



Glen Weiser

University of Idaho

- Attention should be paid to the role of other bacteria e.g. Strep, Staph, **Mycoplasma**, Bordetella and many commensal organisms
- New technology: culture independent methods may play an important role in better understanding respiratory infections in bighorn sheep



Howard Lehmkuhl
USDA National Animal Disease
Center

Viruses as Predisposing Factors
to Bacterial Pneumonia



Howard Lehmkuhl

- Complex multi-factorial nature of respiratory disease in cattle
 - Stress, hunger, dehydration, injury, nutrition, weaning etc. +.....
 - Combinations of viruses and bacteria
 - *Novel – mixing herds
 - *Transition Commensal -> Pathogenic



Howard Lehmkuhl

- OPP, PI3, RSV, BVDV, adenoviruses, and many others play a role in domestic livestock
- Viral infection:
 - Compromises natural host defenses
 - changes environment of lower respiratory tract (LRT). Allows commensal organisms from upper respiratory tract to colonize LRT, reproduce and cause disease



Tom Besser

Washington State University

- Role of *Mycoplasma sp* in Respiratory disease in bighorn sheep
 - *Mycoplasma ovipneumoniae* implicated as a primary infectious agent
 - No single *Pasteurella* is common to pneumonia outbreaks in bighorn sheep



Kathy Potter
Washington Animal Disease
Diagnostic Laboratory

**“Pathologic Examination of
Bighorn Sheep Pneumonia –
Advantages and Limitations”**



Kathy Potter

- Collected live , mild to very sick lambs
- Most had advanced bacterial bronchopneumonia – even with few observed clinical signs
- *Mycoplasma ovipneumoniae* implicated in early stage disease



Kathy Potter

- Provided evidence that there are no strains of *Pasteurella* unique to outbreaks
 - Diverse results and similar to those found in healthy sheep
- Post mortem exam of carcasses and of collected live symptomatic sick sheep may have limited value in determining originating cause
- Live, apparently healthy sheep may provide best information but need to determine which tools to use



Concept 3

- Bighorn sheep are fundamentally different from DS in their susceptibility to respiratory disease



“Sri” Srikumaran
Washington State
University

“Molecular Basis for the Enhanced
Susceptibility of Bighorn Sheep to
Pneumonia: How much do we know?”



“Sri” Srikumaran

Washington State University

- *Mannheimia spp* is the most common commensal of the nasopharynx in BHS, domestic sheep, goats and cattle
- Stress or a viral infection may cause a shift from commensal to pathogen by breaking down defense mechanisms in the lower respiratory tract



“Sri” Srikumaran

Washington State University

- *M. haemolytica* serotype A1 harmless to domestic sheep, yet causes pneumonia in bighorn
- *M. haemolytica* A1 produces a leukotoxin, Lkt, which disrupts immune cells (neutrophils) in the respiratory tract of bighorn sheep



“Sri” Srikumaran

Washington State University

- Lkt causes a release of toxic chemicals from disrupted neutrophils
- Results in extensive cellular damage which enhances further bacterial growth
- Research indicates that BS neutrophils more sensitive to Lkt than those of DS
- Combined with other factors, makes BS more susceptible to severe respiratory disease than DS



Concept 4

Science Informs Management



Trevor Ames

University of Minnesota

“Shipping Fever and Calf
Pneumonia in Cattle”



Enzootic Pneumonia of Dairy and Beef Calves

- *Pasteurella multocida* A:3
- When combined with Bovine Herpes virus results in disease in 100% of calves
- Important cause of disease in calves in feedlots



Enzootic Pneumonia of Dairy and Beef Calves

- Causative factors – Triad
 - Etiologic agents – Viruses and *P. multocida*
 - Calf factors – Respiratory defenses, Immune status, Nutrition, Age
 - Environmental factors



Environmental Factors

- Barns – high temperature, humidity, inadequate fresh air, exposure to older animals, overcrowding
 - Increased pathogen exposure, poor growth and enzootic pneumonia
- Individual calf hutches – fresh air, low exposure and few problems with calf pneumonia



Enzootic Pneumonia of Dairy and Beef Calves

- Solution: House calves in individual hutches to prevent respiratory disease
 - Environmental management solution prevents disease
 - Preventive Herd medicine



Concept 5

Problem Focused Wildlife Management



Craig Stephen Centre for Coastal Health

“Rethinking Causal Relationships
in Free-Ranging Wildlife”



Stephen :Field Based Research

- Identifying the problem
 - Pasteurella
 - Pasteurellosis
 - Increased pneumonia related mortality
 - Bighorn mortality rate exceeds replacement
 - Conflicting priorities for resource use
- Determines the objective – Resolving a wildlife management problem vs. studying a scientific question



Stephen: Wildlife Management Problem

- Solving the wildlife management problem involves
 - Physical environment
 - Social environment
 - Biology
 - Policies and Intervention
 - *Disease Science
- Stakeholders, Epidemiologists, Ecologists, Land Managers, Sociologists, Attorneys



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