

A Common Headline:

“Goats Carry Pathogens That Can Cause Die-Offs In Bighorn Sheep Herds”

Common Justifications cited:

#1) The Rudolph Papers Pertaining To a Hells Canyon Die-Off -- A Now Outdated Publication

From page 901 of the 2003 publication...

phils are reported to be highly sensitive to leukotoxin produced by tested biovariant 1 isolates (Silflow and Foreyt, 1994). In contrast biovariant U^B isolates have been cultured from multiple hosts including bison, moose, and domestic goats (Jaworski et al., 1998; Dyer et al., 2001; Ward et al., 2002), as well as clinically healthy bighorn sheep sampled in Arizona, Idaho, Nevada, and Canada (Ward, unpubl.) and are considered to have a relatively low disease potential for bighorn sheep. Capsular type D ToxA + *P. multocida* strains have been associated with atrophic rhinitis in swine (Chanter and Rutter, 1986) and with disease in goats (Baalsrud, 1987; Zamri-Saad et al., 1996), but their potential for causing disease in bighorn sheep is unknown.

Because samples were not obtained from the animals prior to contact, the direction of transmission could not be ascertained with certainty. The fact that identical strains of *Pasteurella*, particularly biovariant 1 *P. haemolytica*, were isolated from both goats and bighorn sheep is suggestive of transmission of the organisms from goats to bighorn sheep. However, because both the biovariant 1 and ToxA + organisms were limited to the three animals shot on 29 November 1995 and were not isolated from any of the other bighorn sheep in groups A and B, there is no evi-

dence that those organisms were associated with subsequent disease or deaths. Although we know of no other information regarding transfer of potentially lethal *Pasteurella* spp. between domestic goats and free-ranging bighorn sheep, we believe that goats can serve as a reservoir. Thus, interactions between the two species should be avoided to prevent *Pasteurella* transmission that could negatively impact the health of bighorn sheep populations.

Pack goats have gained popularity for use on public and private lands. We recommend that individuals with pack goats have total control of their animals when in or near bighorn sheep habitat, both while on the trail and at the campsite. Likewise, we recommend that any bighorn sheep should be driven away from goats to prevent nose-to-nose contact and that any bighorn sheep that does come into direct contact should be removed from the herd to prevent potential transmission of disease causing organisms to other bighorn sheep.

We gratefully acknowledge many individuals that made important contributions during this study. They include V. Coggins, Oregon Department of Fish and Wildlife; P. Fowler and B. Hall, Washington Department of Fish and Wildlife; H. Akenon, University of Idaho scientist, for her

First and foremost there is nothing in this paper to support the presence of the feral goats as the cause of any pneumonia in bighorn sheep. Most importantly, this paper focuses on specific bacteria (the "Pasteurellas") which are now known to NOT be the primary cause of pneumonia outbreaks in bighorn sheep. There is not, nor was there ever, any epidemiologic evidence to support "Pasteurellas" as being the primary cause of pneumonia in bighorn sheep... which when present, are secondary (opportunistic) agents,

meaning that they attack after the host's defenses are compromised by a primary pathogen (in the case of bighorn sheep, that primary agent is now thought to be *Mycoplasma ovipneumoniae* ["Movi"]).

In reading the conclusion in the papers, the authors give even more evidence that the goats were not the cause of this epizootic of pneumonia by clearly stating that the bacteria isolates that were obtained from the goat "were not isolated from any of the other bighorn sheep in groups A and B, there is no evidence that those organisms were associated with the subsequent disease or deaths" in bighorn sheep. In other words, there was no evidence that the goats had anything to do with the pneumonia outbreaks, and much of the information directed herein at Packgoats, is speculative and unsubstantiated. It is academic that promulgating 'rules' for Packgoat use as was done in this article, has no real value as the recommending individual clearly had/has much more to learn about Packgoat behavior in the wilderness.

Another justification commonly used against the presence of Packgoats in Bighorn habitat:

#2) The Silver Bell Mountains In Arizona -- A Extremely Unfortunate Incident Involving Brush Goats.

"The disease outbreak impacting bighorn sheep in this case was not pneumonia, but rather infectious keratoconjunctivitis, better known as "pinkeye". This pinkeye outbreak coincided with the appearance of a herd of 4800 domestic brush clearing goats that were **legally released** onto a state land grazing allotment in the Silver Bell Mountains in Arizona. Pinkeye can be caused by a number of bacterial agents, and the cause of the Silver Bell bighorn sheep pink eye outbreak was determined to be the bacterium *Mycoplasma conjunctivae*, not to be confused with the pneumonia-associated *Mycoplasma ovipneumoniae*. Considering the large number of domestic goats that were released, it is certainly possible that at least a portion of them were carrying the causative bacteria, *M. conjunctivae*, and brought it into the area with them. Perhaps the most interesting outcome of this interspecies commingling between a large number of brush clearing domestic goats and the resident bighorn sheep is that there were **no reports of pneumonia** associated with this intermingling of species. This is certainly notable since pneumonia is the primary disease concern in bighorn sheep and domestic goats have been implicated (perhaps unjustifiably so) as a source cause of bighorn sheep pneumonia outbreaks, yet no pneumonia was reported even though some of the domestic goats remained in bighorn sheep habitat >60 days.

Packgoats in every case are a small group of goats, in a location isolated from other animals, assiduously watched for any sign of difficulty, and while in the wilderness, they, as a herd animal, are intensely committed to remaining close to their bonded human. An attempt to use this episode as an argument against Packgoats in the wilderness is a manipulative deception.

THE LATEST AVAILABLE SCIENCE AS OF 2015

NAPgA issued a FOIA to Washington State University, including the Washington Animal Disease Diagnostic Laboratory housed at WSU, in order to recover lab results from a 2015 commingling study of domestic goats and bighorn sheep. From documents obtained from the FOIA, an abstract presented at the NWSGC Biennial Symposium in May 2016, and email communications with the WSU researcher that performed the study, we can summarize as follows:

- Movi negative goats and bighorn sheep co-existed in the same pen for 100 days with no signs of sickness in either species.
- After infecting 2 of the Movi-free goats with a "goat strain" of Movi and putting them back into the pen

with the 3 Movi-free bighorn sheep and 3rd domestic goat in the study, the bighorn sheep and the domestic goats all developed “respiratory disease (such as runny noses and coughing)”. NONE OF THE ANIMALS DIED, not even after being housed together for 100 days following Movi introduction into the pen. All of the animals were “euthanized and necropsied to determine definitively whether they had pneumonia lesions”.

During email correspondence with the WSU researcher who conducted the study, we were told that the necropsies were done as a research collaboration with a WADDL and therefore there are “no formal reports” of the necropsy findings. HOWEVER, after spending numerous hours looking through the WADDL documents, we found 3 histopathology reports of interest, 2 of which describe histopathology of lung tissues from 3 goats and 1 report which describes histopathology of lung tissue from 3 bighorn sheep. These reports are dated close to one another near/around the time the commingling study would have been completed, happen to describe 3 domestic goats and 3 bighorn sheep, and the animals are referenced in the reports to be from the WSU researcher who was performing the commingling studies. When the researcher was asked as to whether or not the reports were from the commingling study we received the following response from the researcher “Thanks for your interest in my research program. However, I don’t think I’ll be able to find the time to be able to help you out with this request”. Having communicated multiple times with the researcher, NAPgA thought it odd that the researcher was not willing to answer such a simple question. It may be due to the fact that NONE of the bighorn sheep or goats described in the histopathology reports were diagnosed with pneumonia.....NO PNEUMONIA on microscopic examination of the lung tissues! This is despite the fact that the researcher in previous email communications indicated that “microscopically the lesions were very similar to those seen in many cases of fatal bronchopneumonia in bighorn sheep from the wild” and the title of the WSGC Biennial Symposium abstract describing this work is “*Mycoplasma ovipneumoniae* originating from domestic goats triggers mild bronchopneumonia in experimentally exposed naïve bighorn sheep (and domestic goats)”. Perhaps the gross necropsy examination led the researcher to (over)interpret the lungs as having “pneumonia” or “bronchopneumonia”, but that is certainly not what was reportedly found in the WADDL histopathology reports. It is very much worth noting that microscopic/histopathologic examination of tissue is the most accurate way to interpret lesions in tissues, as gross examinations, particularly of certain tissues including lungs, can be inaccurate.

CONCLUSION - Even when penned in close quarters with domestic goats, the bighorn sheep did not get sick, at least not until Movi was introduced into the pen. Following the infection with Movi, ALL GOATS AND BIGHORN SHEEP showed signs of respiratory disease. NONE of the goats or bighorn sheep died even after 100 days of being exposed to Movi, but rather were euthanized and found to NOT have even microscopic evidence of pneumonia or bronchopneumonia, based on the histologic diagnoses provided in the reports obtained from the FOIA.

2016 GOAT MOVI STUDY CONDUCTED BY DR. MAGGIE HIGHLAND, a Veterinary Medical Officer and Researcher with the USDA-ARS-Animal Disease Research Unit, in collaboration with USDA-APHIS personnel.

From spring through fall of 2016, 576 goats (419 packgoats and 157 housed on premises with packgoats), from 83 premises located in 13 states, were sampled 3 times at 4 week minimum intervals to test for nasal presence/shedding of Movi. Nasal swab samples were collected in duplicate at each time point, with one nasal swab from each sample collection being tested in Dr. Highland’s laboratory and the second swab from the first sample collection being tested in an independent laboratory. Repeat nasal swab sampling of the

goats in this study has confirmed the presence of Movi on just 5 of the 83 premises (6% of premises). Premises that had Movi detected in any of the goats had between 7 to ≥ 15 goats present on the premises. Movi was confirmed to be present on the nasal swabs collected from 30 of the 576 goats tested; this means **94.8% of the goats tested had NO Movi detected on nasal swab samples**. Of the 30 total confirmed Movi positive goats, 27 (or 90%) of them were ≤ 1 year of age (23 of them were < 5 months).

In addition to the nasal swabs, ocular swabs were collected during the first sample collection. Ocular swabs are still being analyzed for the presence of pinkeye-causing bacteria.

In summary, not only does the behavior and handling of pack goats drastically decrease the risk of a domestic pack goat coming into contact with a bighorn sheep, it would seem highly improbable based on this large scale study that a domestic pack goat would even be shedding Movi should such an unlikely contact occur.

NAPgA UNIVERSALLY TEACHES AND EXPECTS THAT ALL GOATPACKERS

MUST be diligent in implementing Best Management Practices such as—

High lining your goats at night, and have your goats under control and/or highlined anytime you are away from your home environment.

Worm your goats regularly.

Know your animal's health status before entering the backcountry. Get a Health Certificate.

Only take healthy goats into the backcountry and STAY COMPLETELY AWAY from Bighorn Sheep.

Consider bells on the collars so you know where your goats are when hiking.

What is the primary reason for this article? We wanted to clear up the confusion that is rampant in the minds of many people regarding the supposed hazard to Bighorn Sheep represented by Packgoats, and also to directly address two of the main articles that have been circulated mitigating against Packgoat use over the years. **#1)** which contains unsubstantiated and speculative information, and **#2)** an unfortunate incident that should never have happened, and which bears no resemblance or relationship to goats used as pack animals in a responsible manner.

Charlie Jennings, President

NAPgA