Prevalence of *Mycoplasma ovipneumoniae* and infectious agents of keratoconjunctivitis ("pinkeye") in domestic and wild small ruminants in Alaska

Domestic small ruminants (sheep and goats) are known to be capable of carrying infectious agents that can be transmitted and cause disease in wildlife species (sheep, goats, muskox), including the pneumonia-associated bacterium *Mycoplasma ovipneumoniae* (often referred to "*Movi*") and bacterial agents that can cause pinkeye. This issue has led to proposals to the Board of Game to remove small domestic ruminants from the ADF&G "Clean List" 5 AAC 92.029 .

Pneumonia outbreaks in bighorn sheep in western North America have and continue to sporadically occur, resulting in varying levels of mortality, with some severe and drastic population losses (up to 75- 90%). In years following an outbreak of pneumonia that may affect all ages of bighorn sheep, lamb pneumonia can continue to occur which can result in lowered or even no lamb recruitment in bighorn herds. Pneumonia has historically been and remains the primary disease concern for wild sheep. Respiratory disease in domestic sheep and goats typically does not have the same heightened morbidity/mortality as has been seen in wild sheep. This may be due to differences in many stress factors (nutrition, access to habitat, microbial and parasite residing in the animal population, acclimation or immunity to the disease agents), genetic differences, and other management factors.

While pneumonia is considered the primary health concern for wild sheep, pinkeye has also been reported in wild sheep following the presence of domestic small ruminants. Blindness, albeit typically temporary in affected wild and domestic small ruminants, can be devastating in wild animals as compared to the housed and cared for domestic animal.

Pneumonia in both domestic and wild small ruminants is a complicated process, and the pathogens that can cause pneumonia, such as *Movi* and other bacteria and viruses, can be carried by clinically healthy sheep and goats, both domestic and wild. *Movi* has been identified as a primary causal agent of epizootic pneumonia in wild sheep in numerous states across western North America and it has been identified as a primary threat to wild sheep populations. Ongoing research has identified multiple strains of *Movi*, some being more virulent than others. More needs to be understood about the prevalence of this bacterium and the associated respiratory disease, carrier states (which seems to vary between sheep and goats), shedding of this bacterium, and the impact of infection on domestic and wild sheep and goats. Due to the severe consequences that *Movi* may have on wild sheep herds, ADF&G has started collecting some surveillance samples from wild sheep and goats across the state and *Movi* has not been identified within Alaska's wild sheep or goat populations so far.

The sheep and goat livestock farms in Alaska are significantly different than what is found in the lower 48 states or in southern British Columbia, Canada. The sheep and goat livestock farms in Alaska are similar to those found in the Yukon, Northwest Territories, and northern British Columbia where there are fewer farms with smaller numbers of sheep and goats per farm so the livestock numbers are much lower. The farm management structure also is different, there are fewer imports into the state, livestock must be confined/fenced and there is no open grazing. Most farms are situated in populated areas of the state not bordering on wild sheep, goat or musk ox habitat; however, scattered farm locations do occur in close proximity to wild sheep and goat ranges. Although reports are rare, wild sheep and goats have been known to foray into urban settings.

There is much that we do not understand about the impact or behavior of this pathogen in either domestic or wild sheep and goats and research studies are trying to answer some of these questions. For example, a 2011 USDA-APHIS National Animal Health Monitoring project that analyzed nasal swabs from 453 operations/farms in

the lower 48 for the presence of *Movi*, a lower percentage of operations with small flocks (<100 sheep) were positive as compared with larger flocks.

We do not know the prevalence of Movi in domestic sheep and goats in the state. The purpose of this study is to gain a better understanding of this issue and try to determine if it is a problem in Alaska. This is a proactive step towards understanding the overall health of our state's sheep and goats.

Since we do not know how many domestic sheep and goats reside in Alaska or the distribution of the farms it is extremely difficult to develop a sampling plan (what number of animals to tests and number of farms that need to be sampled) that will result in a statistically valid prevalence of Movi. Therefore, the best option at this time is to test as many farms as possible, collecting samples from all sheep and goats on each farm. The more animals and farms we can test the better we will be able to evaluate the prevalence of Movi. This allow us to compare our findings to studies done in the western U.S. and Canada so that we can assess the risk and make decisions based on scientific data and knowledge rather than subjective opinions.

The Protocol for the Study:

We would like everyone to understand the goals of the study, realize the results will be confidential, and to encourage as many sheep and goat owners to participate. The last farm census performed in 2012 in Alaska, calculated number of farms with sheep and goats (about 106) and the number of sheep/goats (<1,400). This means on average, each farm would have approximately 13 sheep and/or goats.

- Each farmer participating would sign a Consent Form, this will be mailed separately from the samples. No samples will be processed if this form is not signed.
- Only trained professionals will perform the testing; these individuals will be provided with sample forms and fact sheets prior to sampling, and will be ready to discuss this issue with flock owners.
- Sample supplies will be provided (at no cost) to veterinarians and their assistants.
- Veterinarians/sample collectors will maintain the client *patient confidentiality*. Each farmer will create a farm code and samples will be labeled according to this farm code that only the veterinarian and farmer will know.
- Farms will be grouped into 4 general regions: Interior, Southcentral, Kenai Peninsula/Island herds, and Southeast. This is to help maintain confidentiality when data results are evaluated.
- On the sample sheet, there are some general survey questions about management practices on the farm.
- Shipping will be covered by the study, no cost to the farmer or veterinarian/sample collector.
- The laboratory submission forms will list the farm code, and the age, sex, species of each animal sampled.

Sample collection:

- The sampling plan is to collect a blood sample, eye (conjunctival) swab (one from each eye), and nasal swab from each sheep and goat on the farm. Nasal and conjunctival swabs will be collected on all animals but blood samples will only be drawn from animals 6 months or older.
- Duplicate swabs will be collected on a portion of the animals on the farm.
    - For small flocks or herds under 10 animals collect duplicate samples on all animals.
    - For flocks or herds of more than 10 collect duplicate samples on 20% of the total number.

- ***THEN REPEAT*** *the collection of only the nasal swab* at an interval of approximately 30 days and again 60 days after the first samples were collected.
    - Again collecting duplicate samples as described above.

Paperwork:

- Laboratory submission forms will be sent with the sample collection supplies. The farm code will be written on each sheet to identify the premises.
- Each sample will be given a unique identification number.
- The age, sex and species (sheep or goat) of each animal will be recorded on the submission sheet.
- The farm coded samples will be sent to the USDA Agricultural Research Laboratory (Dr. Highland and Dr. Knowles). The portion of the samples that were collected in duplicate will be sent to Washington State Animal Diagnostic Lab (WADDL) [member of the National Animal Health Laboratory Network –NAHLN] to provide a verification of results from the USDA lab.
- The farm survey with the farm code will be sent with the samples to the USDA laboratory only. A separate submission form will be submitted with samples to WADDL listing the sample number, age, sex and species (sheep or goat) of each animal.

(There will be no charge to the farmer for the diagnostic tests run by either laboratory.)

Results:

- *Laboratory results will be sent to the veterinarian/sample collector who will know the farm code and then report to the farmer or owner.*
- Only the farm code protected data will be sent to the State Veterinarian and shared with the Sheep and Goat Committee. The code protected data will be evaluated by the veterinarians at the laboratories and the Sheep and Goat Committee. Confidentiality will be maintained.

The Goal: We hope to be able to estimate the prevalence of "*Movi"* and bacterial agents of pinkeye in Alaskan sheep and goats in different regions of the state based on the total number of farms participating.

Next steps will be dependent on the data results:

- Development of a Risk Assessment to determine the risk of transmission of pathogens among domestic sheep and goats and wildlife populations.
- Evaluate the need for more testing.
- Determination the mitigation options for preventing interaction among domestic sheep and goats and wildlife.