

Mapping and outfitter correspondence
to improve *Mycoplasma ovipneumoniae*
(M. ovi) surveillance in thinhorn sheep
populations in Yukon, Canada



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1. Executive Summary

The bacterium *Mycobacterium ovipneumoniae* (*M. ovi*) has been associated with pneumonia outbreaks and significant population declines in bighorn sheep in British Columbia, Canada, and the United States. Yukon residents are concerned about the possible deleterious effects of this bacterium in Yukon thinhorn sheep and surveillance for *M. ovi* is an important tool to monitor for, and ideally prevent, outbreaks from occurring. The Animal Health Unit of the Yukon Environment Department tested 120 nasal swab samples from harvested thinhorn sheep for *M. ovi* between 2015-2018. With funding from the Yukon Wild Sheep Foundation, I was able to satisfy two objectives in order to improve surveillance for *M. ovi* in Yukon. First, I mapped the locations from which nasal swab samples have been obtained to date, in order to help determine regions where sample efforts should be focused in the future; second, I corresponded with Yukon outfitters in order to encourage their participation in *M. ovi* surveillance, and to answer any questions or concerns they had about the program. Overall, I identified Yukon Game Management Zones (GMZs) where sampling efforts should be focused based on thinhorn sheep population estimates, historical harvest data, location of *M. ovi* positive samples in Alaska, and certain wildlife habitat ranges. In addition, I identified opportunities to improve confidence in sample results and improve outfitter buy-in to the disease surveillance program.

2. Background

Mycoplasma ovipneumoniae (*M. ovi*) is a bacterium with potential to cause severe respiratory disease in wild thinhorn sheep across their distributional range, including Yukon, Canada (CWHC 2016). *M. ovi* has been identified as a primary cause of pneumonia outbreaks in bighorn sheep in the western USA and British Columbia, Canada (Besser et al. 2010). These outbreaks have been associated with high rates of morbidity (i.e., illness) and mortality (i.e., death), and with previous contact between bighorn sheep and domestic sheep or goats (Besser et al. 2013). In 2016, the CWHC completed a risk assessment for the Yukon Government that recommended increased surveillance for *M. ovi* in wild thinhorn sheep populations. More recently, *M. ovi* was detected in nasal swabs collected from apparently healthy Dall's sheep, mountain goats, caribou, and moose in Alaska, USA (Cotten 2018). In addition, a caribou from the Fortymile herd, found dead in Alaska on May 16, 2018, tested positive for *M. ovi*, and the cause of death was determined to be pneumonia (Cotten 2018). This finding of *M. ovi* in a caribou from the Fortymile herd, which overlaps with thinhorn sheep range in Yukon, underscores the need for increased surveillance in the territory.

The Animal Health Unit (AHU) has been testing in an opportunistic manner for the presence of *M. ovi* in nasal swabs collected from harvested thinhorn sheep in Yukon since 2015. Some hunters have swabbed their sheep at the kill site using sample kits provided by the AHU. In other cases, AHU staff have swabbed sheep heads that hunters have brought into government offices for mandatory verification of age. Concerns from Yukon residents and organizations about the potential for morbidity and mortality associated with *M. ovi* in naïve thinhorn sheep populations also prompts a need for increased, and targeted, surveillance for *M. ovi*; the latter of which requires a better understanding of ideal sample locations.

3. Objectives

My goal with this project was to assist the AHU in improving their surveillance program for *M. ovi* in Yukon thinhorn sheep. To do this, I had two specific objectives:

- 1) To map where nasal swab samples were collected from thinhorn sheep in Yukon from 2015-17. This information will allow the AHU to identify areas where sample collection has been sparse or non-existent in past years, and then target these areas in future.

- 2) To increase awareness among outfitters of the AHU's surveillance program.

Familiarizing outfitters with the surveillance program may prove an efficient way to increase the number of hunter collected samples as each outfitter has direct contact with numerous hunters and thinhorn sheep throughout the harvest season.

4. Determining the Distribution of *M. ovi* Sampling Locations in Yukon

Nasal swabs have been collected from harvested thinhorn sheep in Yukon since 2015 using one of two methods, either by:

- 1) Voluntary submission from hunters using AHU-provided field sample kits or,
- 2) An AHU employee when hunters provided their compulsory submission to the Yukon Environment Department.

Sample kits are available to hunters at Yukon Environment Department offices across the territory prior to and throughout the hunting season. Hunters are encouraged to take a kit with them and collect a nasal swab shortly after death of their harvested sheep (Figure 1).

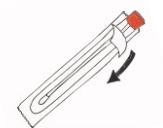
Collecting a sheep nasal swab

- 1 If the nose is dirty, wipe it clean before you begin.

- 2 Open the swab wrapper.

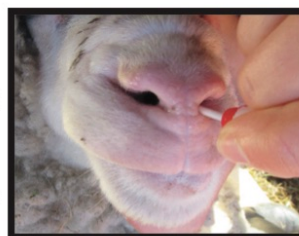
- 3 Remove swab from the tube.

- 4 Do not touch the swab to any surface, including the outside of the nose.



- 5 Insert the swab deep into one nostril, rotate so the swab rubs tissue inside of the nose.

- 6 Repeat in the other nostril. If one nostril contains a lot of blood, only swab the cleaner nostril.

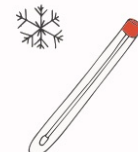


To get deep into the nostril, point the swab towards the back of the throat. The entire swab (up to the red cap) should be in the nose. If you can't push the swab the whole way, try a lower angle.

- 7 Put swab back in tube.



- 8 Keep swab cool or frozen. Return to an Environment office as soon as possible.



Yukon

Figure 1. Instructions for hunters collecting nasal swab samples from Yukon thinhorn sheep to test for *Mycoplasma ovipneumoniae*.

In 2015, nasal swab samples were sent to Prairie Diagnostic Services (Saskatchewan, Canada) and analyzed using a polymerase chain reaction (PCR) for general *Mycoplasma* spp. In contrast, in 2016-2017, nasal swab samples were submitted for a *M. ovi* specific PCR at the Animal Health Centre laboratory operated by the British Columbia Ministry of Agriculture. ArcMap/ArcGIS (Esri) software was used with Publisher Lite (Pearl Mountain Technology Co., Ltd.) to create two maps demonstrating the locations from which nasal swab samples have been collected from harvested thinhorn sheep in Yukon to date.

As of July 2018, the AHU has received and processed 120 thinhorn sheep nasal swabs from 54 Game Management Subzones (GMSs). All samples submitted for testing were negative for *Mycoplasma ovipneumoniae*, and 0.8% (1/120) samples submitted were positive for *Mycoplasma bovis*. Seven samples were removed from the mapping portion of this project, as accurate zone location information was not recorded. It is important to note that *M. bovis* is not considered to be a pathogen of concern in thinhorn sheep at this time (J. Harms, 2016, personal communication).

Two maps were created to show the relationship between the locations (GMSs) from which nasal swabs had been tested for *M. ovi* and:

- i. Thinhorn sheep population estimates collected for the Yukon Environment Department's Sheep Status Reports from 2014 to 2017 for GMZs 5, 7, 8, and 9 (Hegel, Russell, and O'Donohue 2018; Hegel and Russell 2018a,b,c; Figure 2); and
- ii. Total number of thinhorn sheep harvested per GMS from 1980-2014 (Government of Yukon, unpublished data; Figure 3).

GMSs with no sheep counted when surveyed and those areas considered not to be sheep habitat based on the aforementioned Sheep Status Reports were grouped together on Figure 2 as '*Sheep not observed during surveys*'. GMZs which had not been surveyed for sheep in 2015 or later were classified as '*Population estimate unknown*'.

Yukon Thinhorn Sheep *Mycoplasma ovipneumoniae* (*M. ovi*) Sample Locations and Population Estimates (2015-2017)

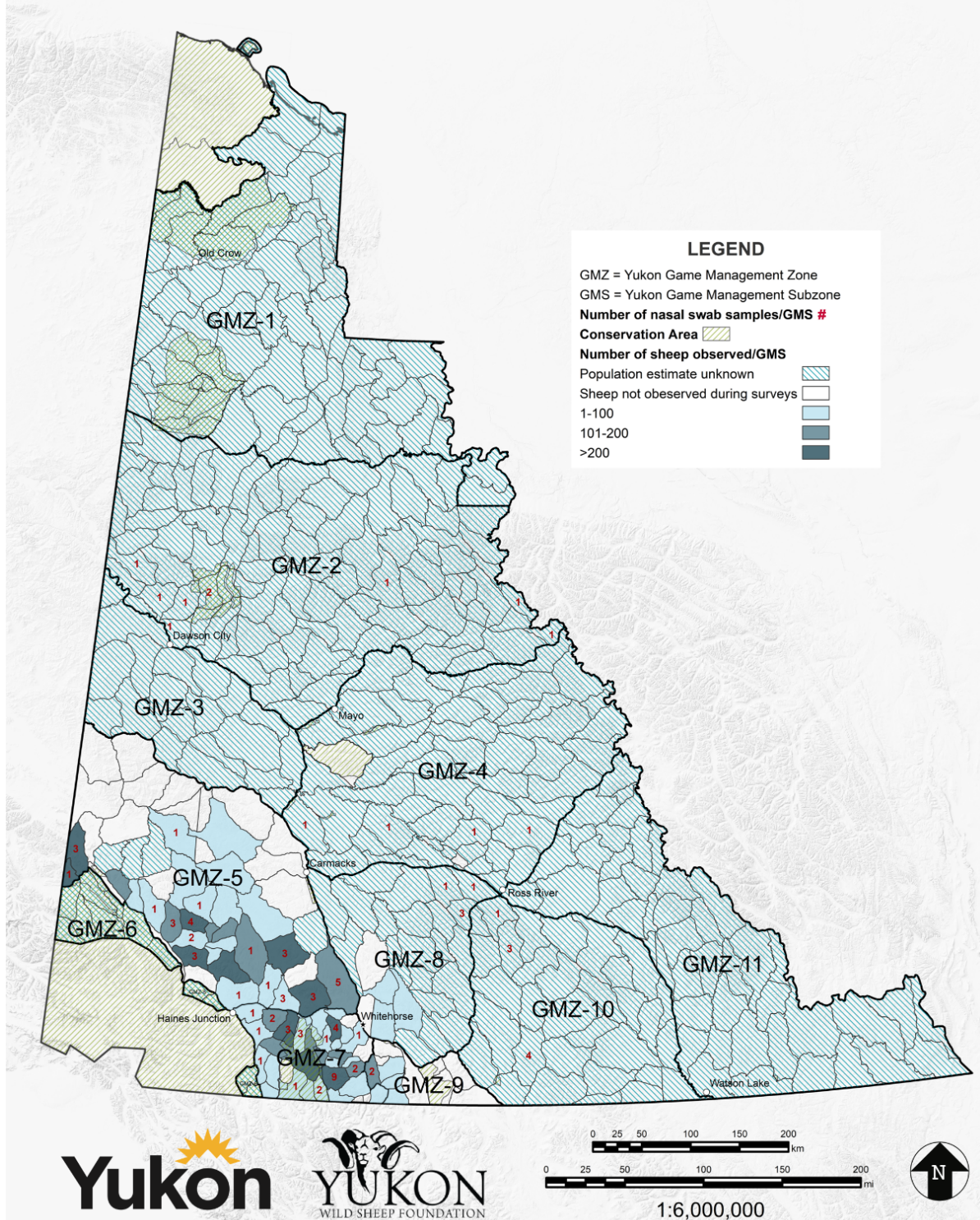


Figure 2. Yukon thinhorn sheep *Mycoplasma ovipneumoniae* (*M. ovi*) sample locations and population estimates (2015-2017).

Yukon Thinhorn Sheep *Mycoplasma ovipneumoniae* (*M. ovi*) Sample Locations and Historical Harvest Counts

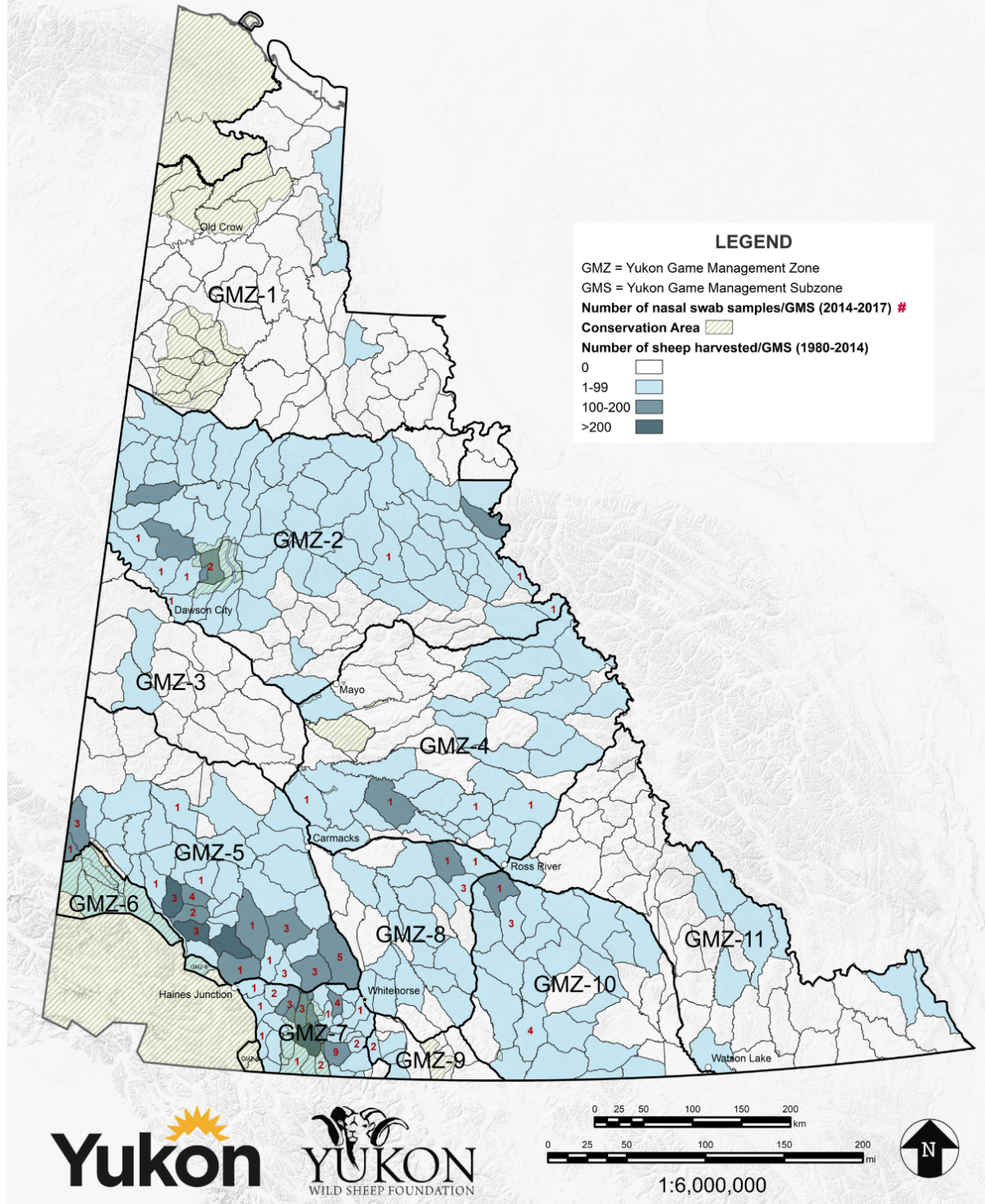


Figure 3. Yukon thinhorn sheep *Mycoplasma pneumoniae* (*M. ovi*) sample locations and historical harvest counts.

In Alaska, genetic material from *M. ovi* was detected in 13/136 (9.6%) Dall's sheep sampled in Game Management Units (GMUs) 12, 13A, 20A, 25C, 26B, and 26C; in 5/39 mountain goats sampled in Unit 15B. None of those 13 sheep or 5 goats showed signs of respiratory illness. Additionally, 5/230 (2.2%) moose and 6/243 (2.5%) caribou sampled also tested positive for *M. ovi*. The locations from which the moose were sampled has not been publicly reported. A caribou from the Fortymile herd was found dead and tested positive for *M. ovi* in various tissue samples. It is presumed that the death of this caribou is linked to its infection with *M. ovi*, making this the first possible case of mortality in a caribou linked to this pathogen (Cotton 2018).

Alaska GMU 12 aligns partially with Yukon GMZ-5 at the Alaska-Yukon border (Figure 4). This is the only Alaska GMU where *M. ovi* has been detected that is in direct relation to the US-Canada border. Given that some of the Yukon GMSs along this border (5-06 and 5-07) have some of the highest reported populations of thinhorn sheep in Yukon, I recommend increasing sampling efforts in these locations, as well as in additional Yukon GMSs along the US-Canada border from Yukon GMZs 6, 5, 3, and 2.

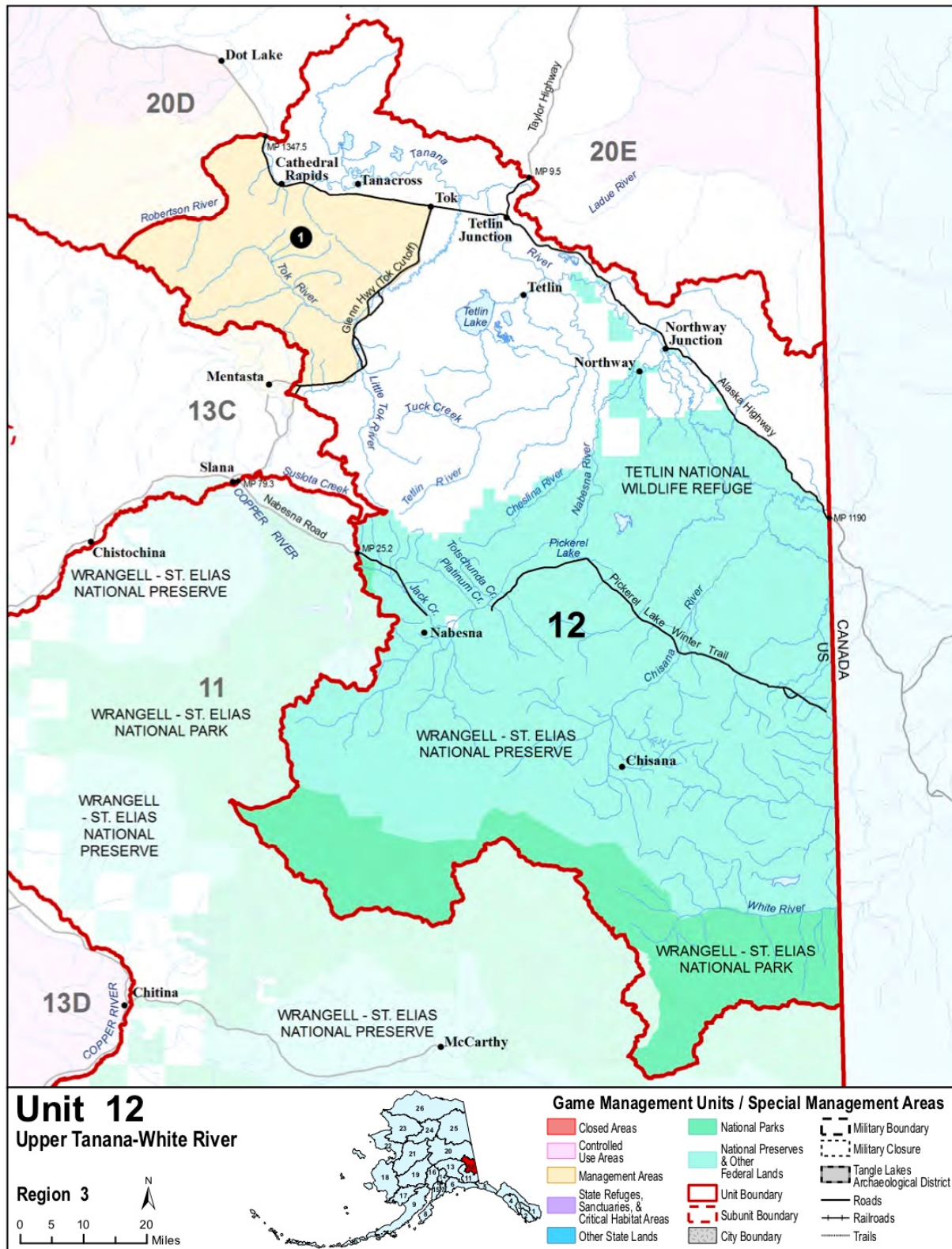


Figure 4. Alaska Game Management Unit (GMU) 12 (Alaska Department of Fish and Game 2018). This is the only GMU where *M. ovi* was detected in Alaska in 2018 that is in direct contact with the US-Canada border.

The Fortymile caribou herd travels between Alaska GMUs 20 and 25 via Yukon GMZs 2 and 3 (Figures 5 and 6). For 2018/2019, Yukon Environment Department has committed to including the collection of nasal swab samples in the routine monitoring of the Fortymile and Porcupine caribou herds, the latter of which also migrates through Yukon GMZs 1 and 2 into Alaska GMUs 25 and 26 annually.

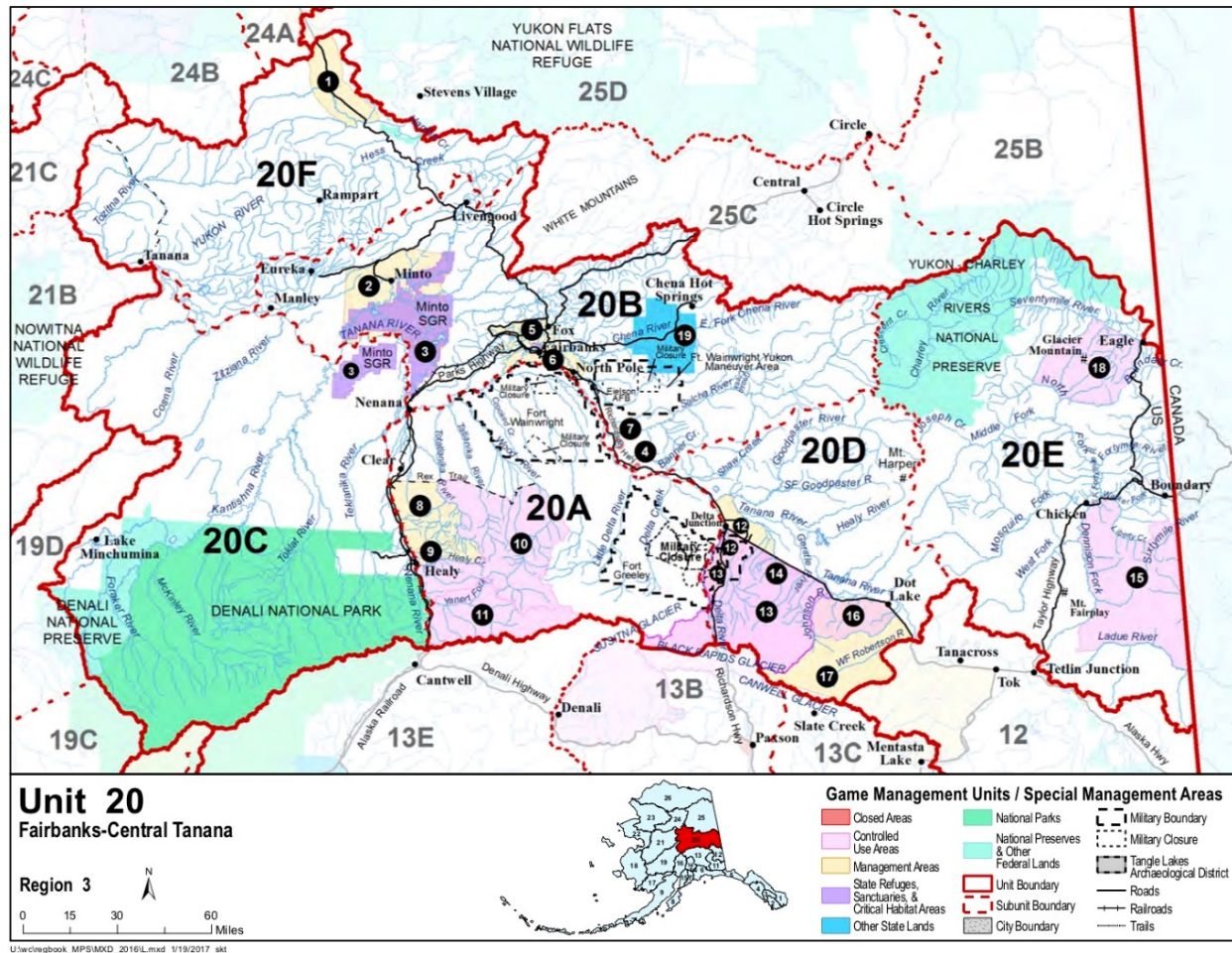


Figure 5. Alaska Game Management Unit (GMU) 20 (Alaska Department of Fish and Game 2018). One individual caribou (*Rangifer tarandus*) from the Fortymile herd tested positive for *M. ovi* in Alaska in 2018. The Fortymile caribou herd potentially crosses the US-Canada border at this GMU.

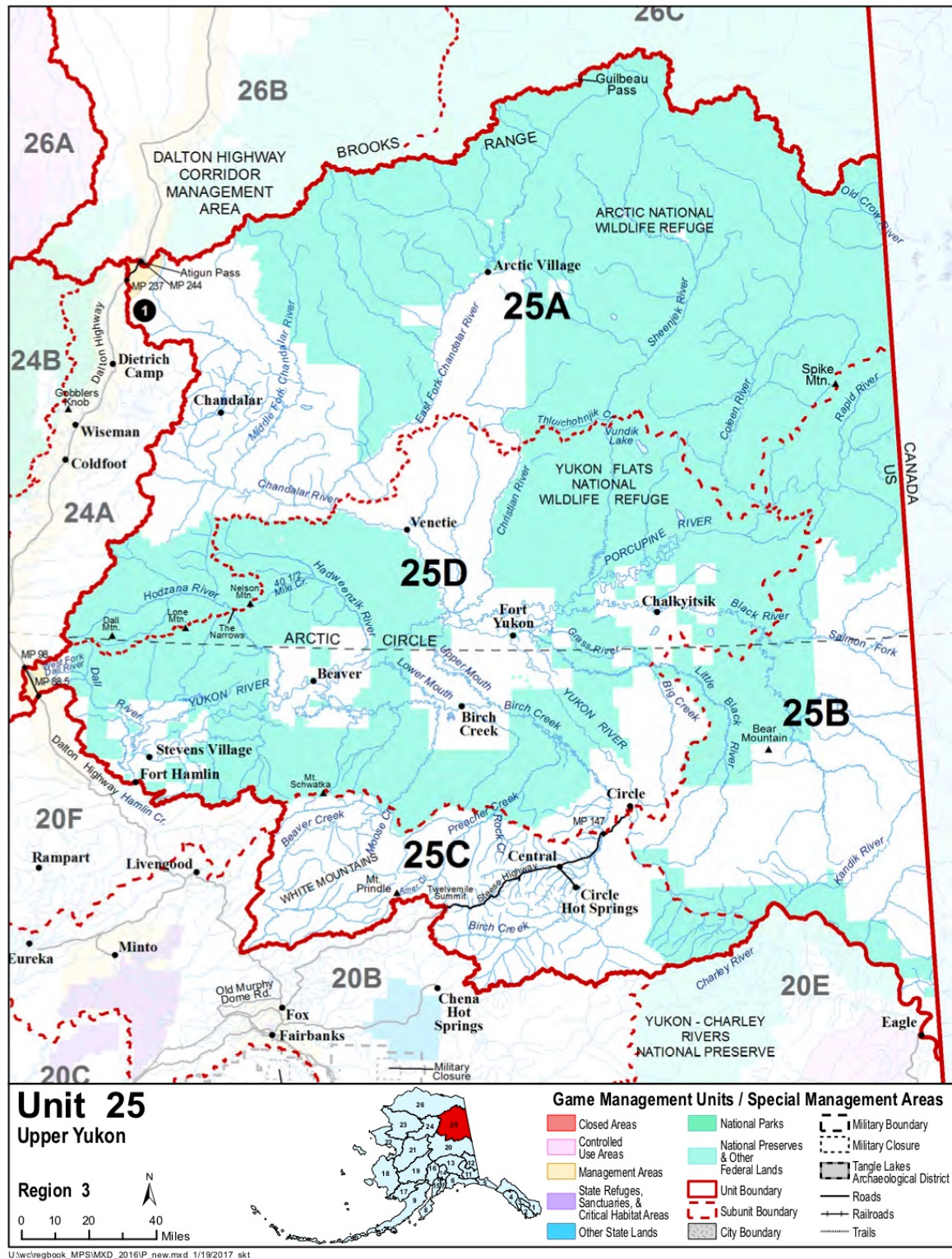


Figure 6. Alaska Game Management Unit (GMU) 25 (Alaska Department of Fish and Game 2018). One individual caribou (*Rangifer tarandus*) from the Fortymile herd tested positive for *M. ovi* in Alaska in 2018. The Fortymile caribou herd potentially crosses the US-Canada border at this GMU.

5. Correspondence with Yukon Outfitters

Since Yukon outfitters have access to areas of the territory that the public typically do not, and they harvest several animals from one region in one year, they were identified as a valuable ally in increasing sampling efforts for *M. ovi*. Therefore, all 22 Yukon outfitters (who are listed below) were contacted by email via the Yukon Wild Sheep Foundation, then I telephoned each outfitter to ensure that they were aware of the program and to address any questions or concerns. The email sent to outfitters by the Yukon Wild Sheep Foundation for the purpose of this project read as follows:

Subject: Seeking Outfitter Assistance with *M. ovi* Monitoring

Dear Outfitter:

The Yukon Wild Sheep Foundation (YWSF) and Government of Yukon Animal Health Unit are increasing *Mycoplasma ovipneumoniae* (*M. ovi*) sampling and disease monitoring in Yukon. The YWSF is funding a veterinary student (Cassy Andrew) to map the locations of previously submitted hunter-collected nasal swabs in order to guide our territory-wide sampling in future. The YWSF will also provide an embroidered, Sitka sponsored, “#*M.ovi* Free Yukon” YWSF ball cap to hunters who submit nasal swabs from harvested sheep.

Your assistance is paramount in this monitoring process. Please help by:

1. Picking up sample kits from the nearest Environment Yukon office.
2. Collecting a nasal swab sample from each individual sheep – a Youtube video on how to properly collect the sample can be found here:
<https://www.youtube.com/watch?v=cafxOH2kVWg>.
3. Submitting your samples to an Environment Yukon office with your compulsory submissions.
4. Receive your ball cap in thanks for helping with this research!

Please note: Cassy will be calling you by the end of the week to answer any questions that you might have about this project.

For more information on this project, please contact:

Helen Christiansen, President, Yukon Wild Sheep Foundation
helen.christiansen@wgh.yk.ca

or

Dr. Michelle Thompson, A/Program Veterinarian, Yukon Department of Environment
michelle.thompson@gov.yk.ca

Thank you for helping protect wild sheep health in Yukon!

The information used to contact outfitters can be found in the table below.

Outfitter Concession No.	Outfitter Contact Information
1	Reynolds Outfitting Ltd. Dan Reynolds Dempster Highway, YT Phone: (867) 993 5946; 993 3494 Email: dreynolds@yknet.ca
2	Blackstone Outfitters Ltd. Jim & Adrienne Fink P.O. Box 31479 Whitehorse, YT, Y1A 6K8 Phone: (587) 802-4338 E-mail: jim@blackstoneoutfitters.com
3	Tombstone Outfitters Inc. Clint Collins RR1 Site 16 Comp 4 Fort St. John BC, V1J 4M6 Phone: (250) 261-3669 Email: info@yukonhunting.ca
4	Midnight Sun Outfitters Ltd. Alan, Jessie and Logan Young Box 40144 Whitehorse, YT, Y1A 6M8 Phone: (867) 633 2885 Email: midnightsunoutfitting@gmail.com
5	Bonnet Plume Outfitters (1989) Ltd. Chris & Sharron McKinnon P.O. Box 89 Calling Lake, AB, T0G 0K0 Phone: (780) 331 2440 Email: chris@huntbpo.com
6	Widrig Outfitters (97) Ltd. Chris Widrig 139 Falaise Rd. Whitehorse, YT, Y1A 3C8 Phone: (867) 393 3802 or (867) 333 9660 (c) Email: chris@widrigoutfitters.com
7	Rogue River Outfitting Jim Shockey Phone: 1 (888) 826 1011 Email: wojo@jimshockey.com
8	MacMillan River Adventures Don Lind Box 458 High Prairie, AB T0G 1E0

	Phone: (780) 523 4455 or (780) 536-5554 (c) Email: don@yukonhuntingoutfitters.com
9	Deuling Stone Outfitters Jarrett Deuling 26 Wann Rd Whitehorse, YT Y1A 5K9 Phone: (859) 983 6442 Email: jarrett@deulingstoneoutfitters.com
10	Dickson Outfitters Ltd. Dave and Teena Dickson Box 9130 – 29 Wann Road Whitehorse, YT Y1A 4A2 Phone: (867) 633 5456 Email: info@dicksonoutfitters.com
11	Prophet Muskwa Outfitters (Kluane) Kevin, Victoria, Sean, and Nathan Olmstead P.O. Box 6677 Fort St. John, BC V1J4J1 Phone: (250) 789 9494/ Nathan cell: (867) 334 3584 Email: info@prophetmuskwa.com
12	Ruby Range Outfitters Ltd. Ross Elliott Box 20070 Whitehorse, YT, Y1A 7A2 Phone: (867) 335-4188 Email: info@rubyrangeoutfitters.com
13	Mervyn's Yukon Outfitting Tim and Jen Mervyn Box 33036 Whitehorse, YT Y1A 5Y5 Phone: (867) 633 6188 Email: access online from http://yukonsheep.com/contact.htm
14	Trophy Stone Outfitting Ltd. Dean and Lori Sandulak P.O. Box 33142 Whitehorse, YT, Y1A 6S1 Phone: (867) 994-2200 Cell: (867) 336-3326 Email: tso@yukonhunting.com
15	Yukon Stone Outfitters Aaron Florian P.O. Box 30177 Whitehorse YT, Y1A 5M2 Phone: (867) 334 9616 or (917) 679 9799 (c) Email: hunt@yukonstone.com
16	Prophet Muskwa Outfitters (Devil Hole) Kevin, Victoria, Sean, and Nathan Olmstead P.O. Box 6677

	Fort St. John, BC V1J4J1 Phone: (250) 789 9494 Email: info@prophetmuskwa.com
17	North Curl Outfitters Mac Watson Box 20800 Whitehorse, YT, Y1A 6N7 Phone: (780) 865 6368 Email: hunt@northcurl.com
19	Cosco's Yukon Outfitting Ltd. Neil and Tara Cosco P.O. Box 33225 Whitehorse YT, Y1A 6S1 Phone: (867) 335 2257 Email: info@coscoyukonoutfitting.com
20	Yukon Big Game Outfitters Shawn and Sandra Raymond Box 38 Whitehorse, YT, Y1A 5X9 Phone: (867) 668-7072 or (250) 264-2512 (c) Email: shawn-ybg@hotmail.com
22	Caesar Lake Outfitters Joel and Courtney Wilkinson Box 868 Watson Lake, YT Phone: 867-335-1211 Email: joelnwilkinson@gmail.com

Of the twenty-two outfitters: (i) one expressed privacy concerns regarding the release of information on the locations from which samples had been obtained; (ii) two expressed concern about the efficacy of sample collection, sample quality, and thus sensitivity of detection of *M.ovi* from nasal swab samples collected by hunters or guides in the field, primarily due to concerns about proper collection and storage; (iii) nine outfitters expressed support for the program and indicated that they would be picking up sample kits for the 2018 hunting season from their nearest Yukon Environment Department office; (iv) seven outfitters were called and voicemail messages were left, but not answered; and (v) one outfitter was not spoken to directly due to out of date contact information.

Conversations with outfitters highlighted two main concerns: privacy and sample quality. When conversing with the outfitter that expressed privacy concerns I explained that sample location at the GMS level would be the only information shared publicly, and that the surveillance is meant to protect the wildlife resources that outfitters rely on. Other outfitters

expressed concerns about the following: comparing results from different jurisdictions, particularly if they are using different labs and/or pathogen detection methods; sample quality control due to varying availability of cold and/or freezing storage in the field; and the sensitivity of nasal swab samples in general to detect *M. ovi*. These concerns will be addressed through upcoming efforts by Yukon Environment Department to increase sample collection and improve the consistency and quality of samples collected.

6. Conclusions

Based on the findings of this analysis, I recommend increasing sampling in a number of GMSs that lie along the US-Canada border, specifically, GMS 204, 205, 206, 213, and 219. These are areas from which thimhorn sheep are historically harvested but have not been sampled for *M. ovi* testing thus far. I also recommend increasing sampling in areas with higher estimated sheep populations as indicated from more recent Yukon Environment Department surveys (2015-2017). This includes GMSs 517, 532, 533, 539, 706, 723, and 724; all are areas from which few samples have been collected.

In order to ensure confidence in the surveillance program and test results, I recommend that Yukon Environment Department continue to stay up to date on the available scientific literature and use existing best practices to guide sample collection efforts. When possible, Environment Yukon should strive to collaborate on sample collection, analysis, and reporting with its neighbouring jurisdictions. Due to the recent finding of *M. ovi* in a number of species in Alaska, I also recommended sampling of other ungulate species in Yukon; specifically, in caribou that migrate into Alaska annually. Lastly, collaboration with outfitters and hunters should continue with effort to ensure that privacy is maintained, while optimizing the health monitoring of Yukon thimhorn sheep.

7. References

- Alaska Department of Fish and Game. 2018. Game Management Unit (GMU) Information (Accessed online 07/17/18 from: <http://www.adfg.alaska.gov/index.cfm?adfg=huntingmaps.gmuinfo>)
- Besser, T.E., M. Highland, K. Baker, E.F. Cassirer, N.J. Anderson, J.M. Ramsey, K. Mansfield, D.L. Bruning, P. Wolff, J.B. Smith, J.A. Jenks. 2012. Causes of pneumonia epizootics among Bighorn Sheep, Western United States, 2008–2010. *Emerging Infectious Diseases* 18:406–414.
- Besser, T.E., E.F. Cassirer, K.A. Potter, J. Vander Schalie, A. Fisher, D.P. Knowles, D.R. Herndon, F.R. Rurangirwa, G.C. Weiser, and S. Srikumaran. 2008. Association of *Mycoplasma ovipneumoniae* infection with population-limiting respiratory disease in free-ranging Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*). *Journal of Clinical Microbiology* 46:423-430.
- Canadian Wildlife Health Cooperative (CWHC). 2016. Risk Assessment of Pneumonia-related Pathogen Transmission from Domestic Small Ruminants to Wild Thinhorn Sheep in Yukon and Northern BC.
- Cotten, S. 2018. Respiratory Pathogen “Movi” Documented in Additional Species in Alaska is Also Implicated in Alaska Caribou Death – Alaska Department of Fish and Game Press Release (Accessed online 07/16/18 from: http://www.adfg.alaska.gov/index.cfm?adfg=pressreleases.pr&release=2018_06_15)
- Hegel, T.M., Russell, K., and M. O'Donoghue. 2018. Status of thinhorn sheep in Game Management Zone 5. Yukon Fish and Wildlife Branch Report, Whitehorse, Yukon, Canada.
- Hegel, T.M. and K. Russell. 2018a. Status of thinhorn sheep in Game Management Zone 7 (2015/2016). Yukon Fish and Wildlife Branch Report, Whitehorse, Yukon, Canada.
- Hegel, T.M. and K. Russell. 2018b. Status of the Joe Mountain thinhorn sheep population - 2016. Yukon Fish and Wildlife Branch Report, Whitehorse, Yukon, Canada.
- Hegel, T.M. and K. Russell. 2018c. Status of Dall's sheep and mountain goats in Game Management Zone 9 (2017). Yukon Fish and Wildlife Branch Report, Whitehorse, Yukon, Canada.