FRASER RIVER BIGHORN SHEEP DISEASE SURVEILLANCE & MITIGATION PROGRAM

Bighorn sheep are an iconic wildlife species in British Columbia and respiratory disease is currently affecting several bighorn sheep herds in the province, including the bighorn sheep along BC's Fraser River, which is an especially important herd in the province. Current science suggests the bacteria *Mycoplasma ovipneumoniae* (Movi) is the single most important pathogen implicated in pneumonia related die-offs of wild sheep and is considered the largest threat to wild sheep in North America. The source of infection is almost always domestic sheep, which have adapted to the disease and are able to live with it. Once infection occurs, this disease is remarkably complex and can persist in populations for many years with no signs of recovery. Following initial exposure, some wild sheep die, at times up to 90% of herds may die, some sheep are able to resist the disease and develop strain-specific immunity and some sheep live with the disease and become chronic shedders of the bacteria through their nasal passages. The disease can persist until all individuals that chronically shed the disease naturally die out which can take a long time as new chronic shedders can continually enter the population (i.e., surviving lambs that become chronic shedders). The bacteria are passed between individuals by direct contact and the annual chain of transmission is generally from a chronically shedding female to their young lamb which then pass along the bacteria to other lambs in the group. Given the immune systems of lambs at that age are developing, often the bacteria causes high levels of lamb mortality within their first couple months of life and the result is persistently low lamb recruitment which prevents long-term recovery of the sheep population.

Given the history of domestic sheep on the Fraser extending back to the early 1900s, Fraser River bighorns have likely been exposed to Movi at various points in time. It appears wild sheep may have recovered from initial transmission events (if they occurred) as wild sheep numbers observed in the early 1990s were the highest ever recorded. At that time, there were an estimated 1,200 – 1,300 sheep between Lillooet and French Bar Creek on the west benches of the Fraser and Canoe Creek on the east benches. In the late 1990s Fraser River bighorn sheep suffered a pneumonia-related die-off and declined in all areas between Lillooet and the junction of the Chilcotin and Fraser Rivers. South of French Bar and Canoe Creeks, bighorn sheep declined to approximately 500 individuals at that time. Numbers recovered slightly in some areas in the following years but generally sheep numbers have never recovered to numbers observed prior to the declines in the late 1990s and have declined back down to approximately 500 animals in the last 2-3 years. Possible re-infection occurred in the mid to late 2000s in the Big Bar and Pavilion areas and we subsequently detected Movi in a couple sick lambs in the area. North of French Bar and Canoe Creeks, wild sheep numbers are also currently at an all-time low. Initially, the 1990s declines were attributed to lungworm, a common parasite of bighorn sheep that can cause pneumonia when sheep become stressed. At that time, very little was known about Movi and the technology did not exist to test for the presence of it. We now suspect that Movi was implicated in those initial declines without our knowledge and we suspect the lack of recovery, and continued declines in some bands of sheep, is due to persistent effects of Movi infection on lamb survival.

As such, to evaluate the distribution and prevalence of Movi in Fraser River bighorns, we established a 2-year surveillance project in the winter 2018/19. Our best information suggests

that 10% of the sheep population should be sampled to assess the distribution and prevalence of Movi. To that end, last winter, we captured and sampled 52 sheep between Lillooet and French Bar and Canoe Creeks and plans are in place to sample approximately 30 sheep in areas to the north this coming winter (Figure 1). We found ~10% of the sheep were actively shedding Movi at time of capture (5/52 PCR positive) and an additional ~20% had positive antibody titers, indicating a history of exposure to the disease (10/52 sero-positive). See Figure 2 below.

Phase 2 of this project seeks to recover Fraser River bighorn sheep by addressing these disease issues. As treating wild sheep is not an option due to the lack of an effective treatment the primary method used to address these issues in other jurisdictions has been a test and remove approach, where wild sheep are captured, tested and those individuals that are found to be actively shedding the bacteria through their nasal passages are removed from the population to break the chain of transmission to young lambs. Where intensively applied, significant success has been achieved with this approach, such as in the Snake River in Idaho, USA, which is a system very similar to the Fraser River system. We are currently considering this approach for the Fraser River.

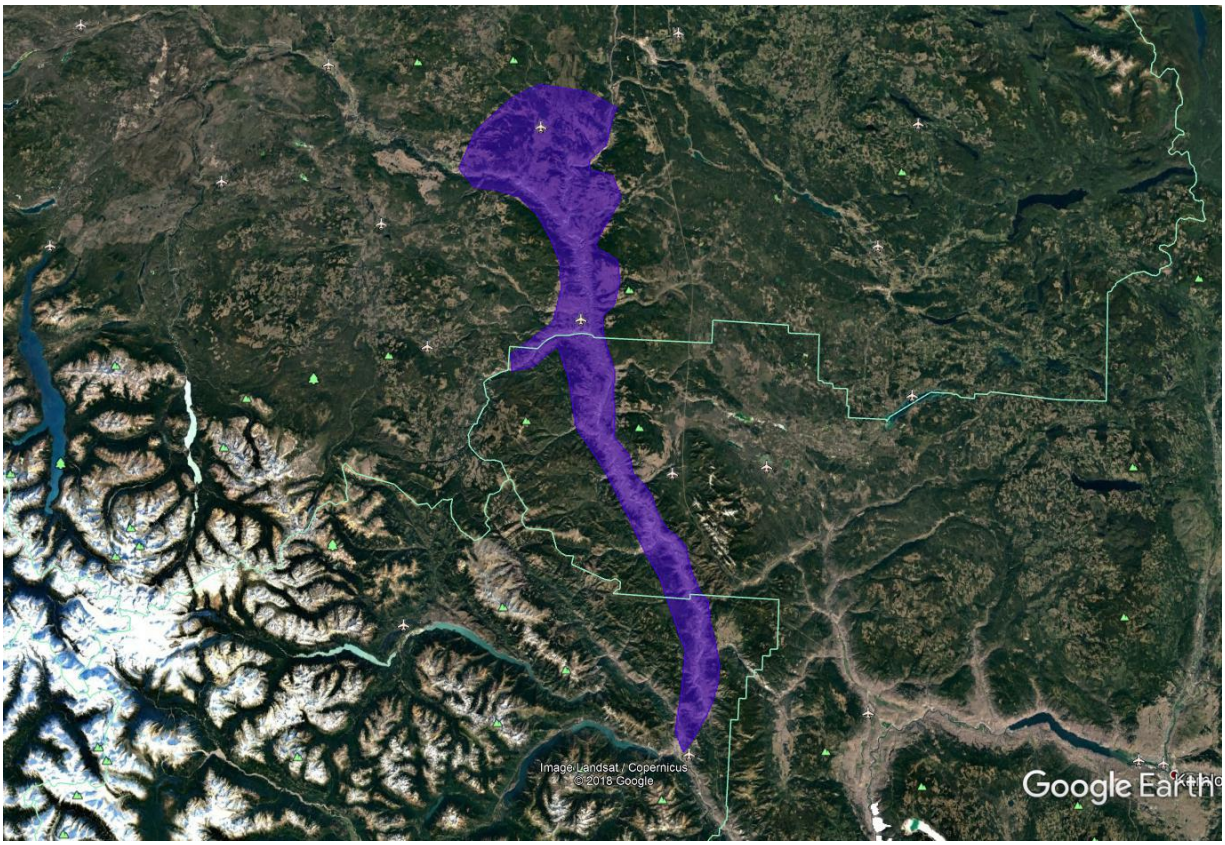

FIGURE 1. Approximate study area boundaries for Fraser River bighorn sheep disease surveillance and mitigation

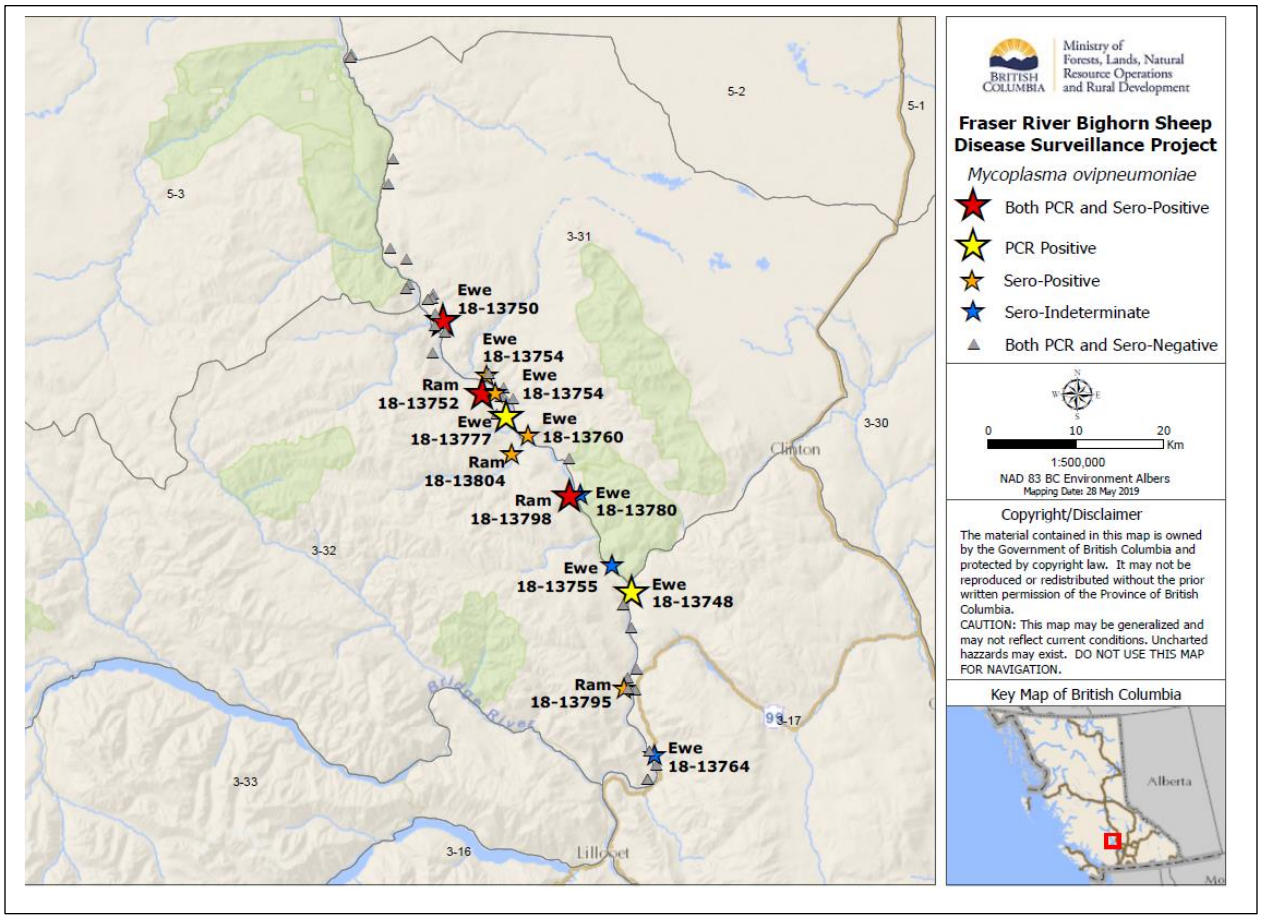

FIGURE 2. Results from bighorn sheep disease surveillance sampling south of French Bar and Canoe Creek on the Fraser River, March 2019.