

## Using Social Grouping and Population Substructure to Improve Test and Remove Management of Bighorn Sheep

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**ABSTRACT:** Bighorn sheep (*Ovis canadensis*) have been widely impacted by *Mycoplasma ovipneumoniae* (*Movi*) and associated polymicrobial pneumonia, causing all-age die-offs, limiting lamb recruitment, and often resulting in long-term population declines or even local extirpations. Due to *Movi*'s ability to persist in populations for decades, management options to restore infected bighorn sheep herds have been extremely limited. Recently, the “test and remove” strategy has been successfully employed mostly in small free-ranging bighorn herds in the U.S. and Canada. However, test and remove requires extensive capture and handling of bighorn over multiple years and its applicability and efficacy in larger herds has received less attention. Building on previous success, a collaborative project was initiated in late 2020 to apply test and remove management in seven populations in Idaho, Oregon, and Washington in effort to restore populations, assess factors that may impact the efficacy of test and remove, and apply an adaptive management strategy to facilitate clearance of *Movi*. Here we analyze social behavior of more than 300 GPS-collared females within populations and report preliminary results in the context of *Movi* infection and exposure. Populations ranged from approximately 60 to 550 in size and were both native and reintroduced. Population substructure was identified by modeling the overlap of home range between each individual female within a population as a directed social network and applying a hierarchical clustering method to estimate social groups. Study populations ranged from no substructure (one social group) to nine. Health testing results differed among populations and observed prevalence of *Movi* infection in adults ranged from 0–25%. We explored differences in infection and exposure within populations to determine whether we could focus on specific subpopulations with higher rates of infection or exposure in larger populations to help improve future capture efforts and facilitate clearance of *Movi*. We found that focusing on subpopulations with higher antibody prevalence or lower lamb survival increased the likelihood of detecting *Movi* carriers.

*Biennial Symposium of the Northern Wild Sheep and Goat Council 24:4; 2024*

**KEYWORDS:** bighorn sheep (*Ovis canadensis*), fitness, gene flow, metapopulation connectivity, *Mycoplasma ovipneumoniae*, Oregon, pathogen transmission, metapopulation, “test and remove”, Washington.