

Estimating Survival Rates of Reintroduced Bighorn Sheep Before and After Exposure to Domestic Sheep

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Abstract: Much has been written regarding the consequences of bighorn sheep (*Ovis canadensis*) and domestic sheep interactions. Penned and field studies have documented bighorns dying shortly after exposure to domestic sheep; however, debate surrounding this controversial topic still exists. From 2000 to 2009, the Utah Division of Wildlife Resources has conducted 11 translocations and released 249 bighorns (143 collared females) onto four mountain ranges in northern Utah. We used Program MARK to estimate monthly survival rates (S) of bighorns before and after contact with domestic sheep. We investigated how disease contracted through interaction with domestic sheep influenced bighorns that were released at different times and from different source populations. In each population, we considered bighorns initially reintroduced as resident animals, whereas bighorns released in subsequent years were considered augmented animals. We observed bighorns interacting with domestic sheep in three populations (Rock Canyon, Mount Nebo, and Mount Timpanogos). Survival for resident and augmented bighorns in Rock Canyon was $S = 0.986$ before exposure to domestic sheep and decreased significantly for resident ($S = 0.778$), but not for augmented bighorns ($S = 0.974$) after exposure. Bighorns on Mount Nebo experienced similar results; survival for resident and augmented bighorns was $S = 0.996$ before exposure to domestic sheep and decreased to $S = 0.750$ for resident and $S = 0.985$ for augmented bighorns after exposure. Although we documented bighorns interacting with domestic sheep on Mount Timpanogos, survival remained constant ($S = 0.983$) for resident and augmented bighorns before and after exposure. To our knowledge, bighorns on the Stansbury Mountains never interacted with domestic sheep, and survival was constant ($S = 0.997$) throughout the study for resident and augmented animals. Our results indicate that disease did not spread uniformly throughout populations of bighorns, because resident bighorns suffered greater mortality after contact with domestic sheep than augmented bighorns. Additionally, our data indicate that not all interactions between bighorns and domestic sheep were fatal, but when dieoffs occurred, they were acute. Finally, our results re-emphasize the importance of spatial separation between bighorn sheep and domestic sheep.

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