

Comparing Ancient and Contemporary Bighorn Sheep Populations Using Bones Recovered from Ice Patches in the Greater Yellowstone Area

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Bighorn sheep have inhabited the Greater Yellowstone Area (GYA) for thousands of years and remain one of the ecosystem's significant large herbivores. Following the arrival of Europeans and domestic sheep grazing, exotic respiratory diseases introduced into the GYA undoubtedly resulted in catastrophic die-offs of bighorn sheep and strong selection for individuals that could mount successful immune defenses. Archaeologists studying receding ice patches in alpine areas of the GYA, e.g., Absaroka-Beartooth Mountains, have identified numerous ancient bighorn sheep skulls, fragments (e.g., horn cores and sheathes), and post-cranial bones, exposed by melting ice. Representative samples radiocarbon date to between 781 and 6311 calendar years before present. We hypothesized the genomes of the pre-contact bighorn sheep recovered from the melting ice would represent the historic condition of native sheep populations when they were more numerous and free of the diseases introduced by domestic sheep. We compared 26 mitochondrial DNA genomes from contemporary bighorn sheep in the Absaroka-Beartooth Mountains with six ancient samples by constructing a phylogenetic tree. Using this information, we evaluated how market hunting and domestic sheep diseases may have influenced the bighorn sheep population. Because mitochondrial DNA is only inherited from the mother, and because bighorn sheep groups of mothers and daughters tend to maintain similar seasonal ranges over multiple generations, we also evaluated if the regional spatial structure of bighorn sheep changed after Euro-American settlement. We believe this study will help determine how the bighorn sheep populations inhabiting the Absaroka-Beartooth Mountains has changed over several thousand years.