



Challenges of Predation Monitoring and Management for Sierra Nevada Bighorn Sheep

DANIEL J. GAMMONS, *Sierra Nevada Bighorn Sheep Recovery Program, California*
Department of Fish and Wildlife, 787 North Main St, Suite 220, Bishop, CA, USA 93514

THOMAS R. STEPHENSON, *Sierra Nevada Bighorn Sheep Recovery Program, California*
Department of Fish and Wildlife, 787 North Main St, Suite 220, Bishop, CA, USA 93514

DAVID W. GERMAN, *Sierra Nevada Bighorn Sheep Recovery Program, California*
Department of Fish and Wildlife, 787 North Main St, Suite 220, Bishop, CA, USA 93514

LACEY GREENE, *Sierra Nevada Bighorn Sheep Recovery Program, California* *Department of*
Fish and Wildlife, 787 North Main St, Suite 220, Bishop, CA, USA 93514

JEFFREY L. DAVIS, *USDA APHIS Wildlife Services, California Region, 3419A Arden Way,*
Sacramento, CA, USA 95825

ABSTRACT: Predation by mountain lions (*Puma concolor*) on federally endangered Sierra Nevada bighorn sheep (*Ovis canadensis sierrae*) has been considered an important management concern since their listing under the Endangered Species Act in 1999. However, quantifying the likelihood and impact of predation is challenging, despite predation being the leading known cause of mortality. We evaluated cause-specific survival rates from radio-marked animals but in some cases these estimates were hampered by small sample sizes, where the fate of a small number of animals can disproportionately influence calculations. An alternative is to incorporate all known deaths from predation, including uncollared animals (which comprised 13% of all known mortalities, 1999-2017), and calculate the proportion of the population killed. Unfortunately, this method is hampered by imprecise count data in some herd-years, despite many counts being near censuses. A further challenge involves monitoring lions themselves because (1) most appear not to prey on bighorn sheep (only 16 of 81 lions monitored during 1999-2017 were known to kill bighorn sheep) and (2) when predation does occur, it is episodic. Of the 4 herds that experienced the most predation in the last 19 years, “predation episodes” occurred in only 7 of 76 (9.2%) herd-years. While this lack of consistent predation may be partially attributable to predation management activities from 1999-2011, an absence of predation in herd-years from 2012-2016, when no predation management activities occurred but lions were documented to be present, indicates that this lion population has intrinsic annual variability in its impact on bighorn sheep. Thus, as predation monitoring and management is resumed, substantial effort may be expended monitoring lions that are unlikely to prey on bighorn sheep. However, inattention to predation could jeopardize achievement of recovery goals in a timely manner. For example, during the winter of 2016-17 we unexpectedly documented a significant predation episode in a herd where predation was previously thought to be unimportant. This recent episode highlighted that despite challenges and uncertainties, under certain conditions, predation of Sierra Nevada bighorn sheep by lions can clearly impede recovery efforts and continued monitoring and management is warranted.



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