DISEASE

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RYAN J. MONELLO - A RANGE-WIDE EVALUATION OF THE POPULATION DYNAMICS AND ECOLOGICAL FACTORS ASSOCIATED WITH BIGHORN SHEEP DIEOFFS

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Abstract: Many bighorn sheep (*Ovis canadensis*) populations throughout much of western North America are characterized by periods of rapid growth followed by drastic declines. The proximate cause of most bighorn mortalities during population dieoffs is the pathogen *Pasteurella* spp., which can cause pneumonia and death in infected animals. We examined factors potentially predisposing bighorn sheep to pneumonia-related population declines by assessing the correlation between bighorn population trends and environmental and biological factors. We collected information on composition and demography, precipitation, and temperature data for 174 sheep populations ranging from the southwestern U.S. to Alaska. The majority of pneumonia outbreaks were found in Rocky Mountain (*Ovis canadensis canadensis*) as opposed to Desert (*Ovis canadensis nelsoni*) or California bighorn sheep (*Ovis canadensis californiana*). Of these, 88% of the dieoffs occurred at or within three years of peak herd numbers. Lambs experienced significantly higher mortality rates (66% in year of dieoff), but mortality rates were similar among rams (35%) and ewes (42%). No significant differences in herd growth rates were found between non-dieoff and pneumonia dieoff populations prior to dieoff, although herds that experience a dieoff due to pneumonia and non-pneumonia factors tended to have lower growth rates. All herds tended to grow exponentially or linearly prior to a peak or dieoff, irrespective of their disease status. Our analyses of monthly/annual precipitation and temperature data from areas close to bighorn herds failed to detect differences between non-dieoff or pneumonia dieoff populations. However, we detected a qualitative relationship between pneumonia epizootics and harsh weather conditions, where summer/fall outbreaks tended to occur in years of lower than average precipitation and higher than average temperatures. Herds which experienced a pnuemonia dieoff were located significantly closer to domestic sheep allotments than either non-dieoff or non-pneumonia dieoff herds. This information, combined with the finding that herds grow rapidly immediately prior dieoff, implies that herds are likely more vulnerable to pneumonia due to an increased probability of contact with domestic sheep. Accordingly, we reject the hypothesis that density-dependent effects of food limitation on disease immunity and stress cause a pneumonia dieoff. Our results suggest that appropriate management options for the control or mitigation of pneumonia dieoffs in bighorn sheep may include the need to keep populations at low numbers via increased ewe and ram harvest rates and, where applicable, termination of predator control programs.