

Disease introduction is associated with a phase transition in bighorn sheep demographics

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ABSTRACT Ecological theory suggests that pathogens are capable of regulating or limiting host population dynamics, and this relationship has been empirically established in several settings. However, although studies of juvenile disease were integral to the development of disease ecology, few studies show population limitation by a juvenile disease. Here, we studied twelve bighorn sheep (*Ovis canadensis*) populations and found a strong association between disease invasion and ensuing host population growth rates. While bighorn populations generally increased ($\lambda = 1.11$) prior to disease introduction, most of these same populations experienced an abrupt change in trajectory at the time of disease invasion, usually followed by stagnant-to-declining growth rates ($\lambda = 0.98$) over the next twenty years. Disease-induced juvenile mortalities imposed strong constraints on population growth that were not observed prior to disease introduction, even as adult survival returned to pre-invasion levels. Simulations suggested that models with persistent juvenile disease qualitatively matched observed population trajectories, whereas models that only incorporated all-age disease events did not. We use these results to argue that pathogen persistence may pose a lasting, but under-recognized, threat to host populations, particularly in cases where clinical disease manifests primarily in juveniles.

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KEY WORDS bighorn sheep, childhood disease, integrated population model, pathogen persistence, population projection matrix, vital rates, disease-induced mortality, wildlife disease, demographic trends

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