



The Implications of Imperfect Detection for Establishing the Presence/Absence of Pathogens: A Web-Based Resource for Managers

J. TERRILL PATERSON, *Fish and Wildlife Ecology and Management Program, Ecology Department, Montana State University, Bozeman, MT, USA 59717*

CARSON J. BUTLER, *Fish and Wildlife Ecology and Management Program, Ecology Department, Montana State University, Bozeman, MT, USA 59717*

JAY J. ROTELLA, *Fish and Wildlife Ecology and Management Program, Ecology Department, Montana State University, Bozeman, MT, USA 59717*

ROBERT A. GARROTT, *Fish and Wildlife Ecology and Management Program, Ecology Department, Montana State University, Bozeman, MT, USA 59717*

ABSTRACT: A key factor for the informed management of populations of wild animals is the ability to accurately determine the presence or absence of pathogens. The infection status of groups has important implications for the translocations of individuals, herd-level accreditation of freedom from infection, as well as understanding the risks of pathogen transmission between wild and domestic animals. However, accurately assessing the presence of pathogens is complicated by imperfect detection, which results in uncertainty regarding pathogen presence even in the face of no positive test results. The accurate assessment of pathogen presence also requires evaluating the consequences of assuming binomial or hypergeometric sampling. Here, we develop a flexible, Bayesian-based framework for estimating the probability of pathogen presence and its uncertainty. We demonstrate our approach by evaluating the consequences of imperfect detection for a variety of respiratory pathogens in bighorn sheep (*Ovis canadensis*). We then generalize this framework by developing a web-based application to make this estimation methodology more widely available. Using test results, this application allows users to estimate the probability of pathogen presence, or prevalence in the event of positive tests, by controlling parameters related to sampling design and detection probabilities. Furthermore, it informs sampling design by allowing users to determine the sample size and number of replicate tests per individual that are required to achieve a specified confidence in the probability of pathogen presence. Overall, this work has produced a practical, readily-accessible, and easily-used tool that will allow managers to assess the probability of pathogen presence/absence in wild populations.

Biennial Symposium of the Northern Wild Sheep and Goat Council 21:114; 2018

KEY WORDS Bighorn sheep; *Ovis canadensis*; pathogen presence; pathogen detection; prevalence; web-based application; sampling design.