

POPULATION IMPACTS OF BANDING KING PENGUINS: A MODELLING APPROACH

C. Ribic¹, D. Heisey², J. Cary³, M. Gauthier-Clerc⁴, Y. Le Maho⁵, C. Le Bohec⁵, J.-P. Gendner⁵, W. Fraser⁶, E. Woehler⁷

¹USGS Wisconsin Cooperative Wildlife Research Unit, Madison, WI, United States, ²USGS National Wildlife Health Center, Madison, WI, United States, ³Department of Wildlife Ecology, University of Wisconsin, Madison, WI, United States, ⁴Station Biologique de la Tour du Valat, Arles, France, ⁵CEPE-CNRS, Strasbourg, France, ⁶Polar Oceans Research Group, Sheridan, MT, United States, ⁷University of Tasmania, Sand Bay 7005, Tasmania, Australia

Reduced reproductive success in flipper-banded King Penguins compared to unbanded penguins has been reported but differences in survival were not found. The “worst-case” survival analysis done by previous researchers assumed that death occurred at the beginning of the tail chain of absences. It would be expected that this approach underestimates the survival curve because it uses the lower bound on the possible death time. Thus, our goal was to examine the extent to which a reasonable model for nonresightability might shift these results. Because of the clearly seasonal nature of the data, we developed a Bayesian method that was as nonparametric as possible with respect to time-specific survival estimation. The basic model structure was the three-state Markov illness-death model with recovery (Anderson et al 1993), with the state “not detected on the colony but not dead” being analogous to illness. Given the incomplete observations of states in our situation, a hidden Markov model (HMM) approach (e.g., Pradel 2005) was used. Using 7 years of post-banding data, we found support for the notion that decreased survival, or at least an increased chance of not returning to the colony, was associated with flipper banding. Using these survival estimates and published estimates of other parameters, we developed a simple individual-based population model to estimate the impacts of differential survival and reproduction on the population growth of a King Penguin colony. Preliminary results for a colony initially set with a lambda slightly greater than 1 indicates that a population can tolerate a small percentage of banded adults before lambda is reduced below 1. The exact percentage where a decline starts to occur will depend on the growth rate of the colony.