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## Abstract

The Bathurst herd of barren-ground caribou (*Rangifer tarandus groenlandicus*) in the Canadian central arctic declined from an estimated 203,800 to 16,400 breeding females from 1986 to 2009, with the most rapid decline from 2006 to 2009. A key research and management question was whether the decline was mainly due to decreases in productivity alone or also due to reduced adult female survival. Investigating causes of the decline was hampered by a lack of direct estimates of caribou demographic parameters. We developed a demographic model that could be objectively fitted to field data to explore the mechanisms for the Bathurst decline, with a focus on the recent accelerated decline from 2006 to 2009. Our modeling indicated that the decline was driven by increasing negative trends in adult female and calf survival rates and possibly reduced fecundity. The effect of a constant hunter harvest on the declining herd was one potential cause for the recent accelerated decline in adult survival. The demographic model detected negative trends in adult female survival that were not detected using standalone analyses of collar-based survival data. The model allowed rigorous interpretation of trends in productivity by controlling for the simultaneous influence of trends in adult, calf, and yearling survival and adult fecundity on field-based calf–cow ratios. Stochastic simulations suggested that large increases in adult survival and productivity would be needed for the herd to recover. Our methods enable objective modeling of caribou demography that can assist in caribou management based upon all sources of available data.