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ABSTRACT

Sex matters - effects of climate and density-dependence on adult sex ratio variation in a large Arctic herbivore

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In order to predict population dynamics in large mammals, a mechanistic understanding of how population density and environmental drivers affect the demography is crucial. In ungulates, it is well known that variation in adult sex ratio can affect population demography and dynamics, yet the natural mechanisms behind this variation remain unclear.

Here we examine how sex-specific effects of climate and population density influence annual changes in adult sex ratios in predator-free wild Svalbard reindeer (*Rangifer tarandus platyrhynchus*, Vrolik 1829), a high Arctic model species with highly fluctuating vital rates and population dynamics. We used population monitoring data from two neighbouring yet semi-isolated populations where sex- and age-structured summer counts of live and dead reindeer (i.e. carcass counts) have been performed for up to 35 years.

Both study populations showed sex-specific density-dependence and effects of winter precipitation, a proxy for the harshness of feeding conditions during the critical period for survival. An increase in winter precipitation had a stronger negative effect on adult survival in males than in females, and reduced the adult population growth rates of males, but not females. In contrast, an increase in population density caused a stronger decline in female than male adult population growth rates. This was likely due to higher proportions of senescent females than males at high population density, causing sex-differences in density-dependent fluctuations in age structure (i.e. “apparent density-dependence”). Accordingly, the overall female-bias in adult sex ratios was found to increase with harsher winter conditions and decline with higher population density.

The results from this simple model system suggest that major drivers of ungulate population dynamics can operate differently among the sexes due to differences in life-history strategy. By demonstrating for the first time that climate and population density influence adult sex ratios in an ungulate, the study has wide implications for

management and harvest regimes, especially under future climate change.