



Projecting the effects of climate change on mountain goat population dynamics in Alaska

KEVIN S. WHITE, *Alaska Department of Fish and Game, Division of Wildlife Conservation, P.O. Box 110024, Juneau, AK, USA 99811*

DAVID P. GREGOVICH, *Alaska Department of Fish and Game, Division of Wildlife Conservation, P.O. Box 110024, Juneau, AK, USA 99811*

TAAL LEVI, *Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR, USA 97331*

ABSTRACT: Climate change represents a primary threat to species persistence and biodiversity at a global scale. Cold adapted alpine species, such as mountain goats (*Oreamnos americanus*), are especially sensitive to climate change and can offer key “early warning signs” about deleterious effects of predicted change. Among mountain ungulates, survival, a key determinant of demographic performance, may be influenced by future climate in complex, and possibly opposing ways. Demographic data collected from 447 mountain goats in 10 coastal Alaska, USA, populations over a 37 year time span indicated that survival is highest during low snowfall winters and cool summers. However, General Circulation Models (GCMs) predict future increase in summer temperature and decline in winter snowfall. To disentangle how these opposing climate-driven effects influence mountain goat populations, we developed an age-structured population model to project mountain goat population trajectories for 10 different GCM/emissions scenarios relevant for coastal Alaska. Projected increases in summer temperature had stronger negative effects on population trajectories than the positive demographic effects of reduced winter snowfall. In 5 of the 10 GCM/RCP scenarios, the net effect of projected climate change was extinction over a 70 year time window (2015–2085); smaller initial populations were more likely to go extinct faster than larger populations. Using a resource selection modeling approach, we determined that distributional shifts to higher elevation (i.e. “thermoneutral”) summer range was unlikely to be a viable behavioral adaptation strategy; due to the conical shape of mountains, summer range was expected to decline by 17–86% for 7 of the 10 GCM/RCP scenarios. Projected declines of mountain goat populations are driven by climate-linked bottom-up mechanisms and may have wide ranging implications for alpine ecosystems. These analyses elucidate how projected climate change can negatively alter population dynamics of a sentinel alpine species and provide insight into how demographic modeling can be used to assess risk to species persistence.

Biennial Symposium of the Northern Wild Sheep and Goat Council 21:77; 2018

KEYWORDS Mountain goats; *Oreamnos americanus*; alpine ecosystems; climate change; conservation; general circulation models; habitat change; population modeling; resource selection function; Alaska.