The Impact of Climate Variation on Columbia Spotted Frog Survival in a High Mountain Ecosystem

Rebecca McCaffery, Wildlife Biology Program, University of Montana, Missoula, Montana 59812

Bryce Maxell, Montana Natural Heritage Program, Helena, Montana 59620

Amid growing concern over the impacts of long-term climate change, a fundamental challenge for wildlife biologists is determining how animal populations will respond to a changing climate. In amphibians, little research has addressed how climate variation may affect vital rates and population sizes. We evaluated the relationship between annual age- and sex-specific survival rates and local and global climate variables using a nine-year mark-recapture dataset of Columbia spotted frogs (*Rana luteiventris*) from the Bitterroot Mountains. Local climate variables included peak snowpack, winter length, summer length, and growing degree days. Global climate variables included the Southern Oscillation Index (SOI) and the North Pacific Oscillation (NPO). We estimated annual survival for four age classes: juveniles, subadult and adult females, and adult males. We found that survival in this population was best predicted by snowpack and winter length. In this model, an increase in snowpack resulted in a decrease in juvenile ($b = -0.083 \pm 0.007$), adult male ($b = -0.036 \pm 0.016$), and

adult female (b= -0.037±0.015) survival, and had no significant effect on subadult survival (b = -0.011±0.027). An increase in winter length led to a slight increase in survival, but only for juveniles and adult males. These results suggest that a warming climate with less severe winters might be good for montane frog populations. Survival is only one vital rate, however, and future work will determine the influence of climate on other vital rates such as growth and fecundity, as well as examine the contribution of intrinsic drivers to population variation.