
ELK CALF SURVIVAL AND ELK POPULATION DYNAMICS IN THE SOUTHERN BITTERROOT VALLEY

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In response to declining elk calf recruitment in the southern Bitterroot Valley of Montana, we initiated a 3-year study to determine the importance of bottom-up and top-down factors for elk calf survival and elk population dynamics. We monitored the survival of 286 elk calves during 2011-2014 in order to estimate cause-specific mortality and calf survival to age 1. We used continuous-time survival modeling to evaluate the effect of risk covariates and estimate calf survival and cause-specific mortality rates. Annual elk calf survival was 0.32 in 2011, 0.43 in 2012, and 0.45 in 2013. We found that mountain lions (20%) were the most important mortality source for elk calves, followed by unknown causes (17%), unknown predation (9%), bear predation (5%), natural, non-predation (4%), wolf predation (3%), and human-related mortality (1%). Male elk calves were at 63% higher risk of mortality than females ($P = 0.01$), and elk calves in the West Fork area were at 42% higher risk of mortality compared to the East Fork ($P = 0.07$) during their first year. Also, we detected a significant positive effect of estimated birth date on summer mortality risk for elk calves ($P = 0.07$). We will use integrated population modeling to combine elk calf and adult female survival, nutrition, and carnivore population data, allowing us to forecast the effect of habitat and carnivore densities on elk population trends. These tools may help managers balance carnivore and ungulate population objectives and is applicable to all areas experiencing carnivore recovery.