Trends in Causes and Distribution, and Effects of Whitebark Pine Decline on Grizzly Bear Mortality in the Greater Yellowstone Ecosystem

Mark A. Haroldson,* U.S. Geological Survey, Interagency Grizzly Bear Study Team, Northern Rocky Mountain Science Center, Bozeman, Montana 59715

Frank T. van Manen, U.S. Geological Survey, Interagency Grizzly Bear Study Team, Northern Rocky Mountain Science Center, Bozeman, Montana 59715

Mike R. Ebinger, University of Montana, College of Forestry and Conservation, Missoula, Montana 59812

Megan D. Higgs, Department of Mathematical Sciences, Montana State University, Bozeman, Montana 59717

Daniel L. Bjornlie, Large Carnivore Section, Wyoming Game and Fish Department, Lander, Wyoming 82520

Kerry A. Gunther, Bear Management Office, Yellowstone Center for Resources, Yellowstone National Park, Wyoming 82190

Kevin L. Frey, Montana Fish, Wildlife and Parks, Bozeman, Montana 59717

Steve L. Cain, Grand Teton National Park, Moose, Wyoming 83012

Byan C. Aber, Idaho Department of Fish & Game/USDA Forest Service, Island Park, Idaho 83429

Documented grizzly bear (*Ursus arctos*) mortalities have been increasing in recent years in the Greater Yellowstone Ecosystem (GYE), due, in part, to increases in bear numbers and range expansion. Previous research has documented that variable seed production of whitebark pine (WBP; *Pinus albicaulis*), an important fall food, is inversely related to grizzly bear fall mortality. However, WBP has experienced widespread mortality during the last decade because of mountain pine beetle (*Dendroctonus ponderosae*) infestations. We investigated trends in causes and distribution of human-caused mortalities for independent-aged (≥ 2 yrs old) grizzly bears in the GYE during 1975–2012, and the effect of WBP cone production on numbers of fall (> 1 August) mortalities (n = 172) during the period of WBP decline (2000-2012) using Poisson regression. During 1975–1982, 91 percent of mortalities occurred within the Grizzly Bear Recovery Zone and primary causes were poaching/malicious killings and losses related to conflicts with livestock. During the two most recent decades most mortalities were associated with ungulate hunting, usually involving self-defense kills, or anthropogenic sites, and an increasing percentage of mortalities occurred outside the recovery zone. Using predictor variables of cone production, sex, location in or out of the Recovery Zone, and year suggests: 1) annual cone production was still predictive of human-caused fall mortalities, 2) no evidence of a difference in annual numbers of fall mortalities between males and females, and 3) an increase in annual mortalities over the study period, with most of this increase outside the Recovery Zone.