

Re-evaluation of Yellowstone Grizzly Bear Population Dynamics Provides Flawed Insights:

Response to Doak & Cutler

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Doak & Cutler (2013) critiqued methods used by the Interagency Grizzly Bear Study Team (IGBST) to estimate grizzly bear (*Ursus arctos*) population size and trend in the Greater Yellowstone Ecosystem (GYE). They used simulations to support their claim that IGBST monitoring of population trend based on Chao2 estimates of females with cubs-of-the-year (F_{COY}) (Keating *et al.* 2002, Cherry *et al.* 2007) is biased because search effort (flight hours) increased over time. Their model assumed that any F_{COY} within ~20,000–45,000 km² of occupied habitat (1986–2001) was potentially observable during any given flight hour, which is clearly unreasonable. We further demonstrate their claim that population trend increased as a direct result of more flight hours was not statistically supported by their own simulations and even less so when we used effort/area surveyed to account for population expansion (Fig. S2). Doak & Cutler further argued that by not accounting for survival and reproductive senescence, IGBST's demographic projection models overestimate population growth. This statement is incorrect because influence of age on survival and fecundity were investigated in detail (Harris *et al.* 2006, 2007; Haroldson 2006) but resulted in negligible changes in population trajectory. Doak & Cutler support their senescence argument with another set of simulations using a baseline model with constant survival and fecundity as implemented by IGBST. The survival senescence function they used, however, was so extreme that female survival decreased from 0.949 at age 19 to essentially no survival for ages ≥ 21 , unsupported by empirical data and unrealistic for any grizzly bear population (Fig. S5). They assessed effects of age-specific fecundity using Schwartz *et al.* (2003) and developed a baseline projection model (constant fecundity across age) based on Harris *et al.* (2007). However, these fecundities come from very different sources (Fig. S6), were constructed for very different reasons, and led Doak & Cutler to misinterpret the influence of reproductive senescence (Fig. S7). Where Doak & Cutler

documented 3.6% (high survival scenario) and 3.5% (low survival) reduction of annual population growth from survival and reproductive senescence combined, our additional simulations using IGBST estimates of age-specific survival and an appropriate baseline model for fecundity indicated only 0.4% and 0% reduction in population growth, respectively (Table S1). Doak & Cutler's choice of extreme survival and incompatible reproductive senescence functions substantially influenced their simulation results, leading to erroneous conclusions. We conclude their critique is unfounded when placed within the context of a thorough understanding of the data, the study system, and previous research findings and publications. The task of IGBST is to use the best available science to ensure that federal and state agencies have objective and reliable data upon which to base their policy and management decisions (e.g., Schwartz *et al.* 2006). Thorough scientific review is critical to the process and can lead to important insights. However, based on our examination of their critique, Doak & Cutler do not provide such insights. The scientific basis for our rebuttal is detailed in Supplemental Information.

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