

Two-sex Integrated Population Model Reveals Differences in Life History Strategies for Female and Male Cooper's Hawks (*Accipiter cooperii*)

Integrated population models (IPMs) combine population counts with demographic data to improve the precision of estimates of population size and demographic rates. IPMs can also provide information on demographic parameters for which data are lacking (e.g., immigration), if other sufficient information is available. IPMs are structured around a matrix population model that reflects the life cycle of the species. IPMs often use demographic data from one sex, usually females, implicitly assuming the chosen sex adequately represents the species' life history; for highly size-dimorphic raptors, that assumption may not hold true. We developed a two-sex IPM for a New Mexico population of the highly size-dimorphic Cooper's Hawk using data from 2011–2020 and compared estimates of life history characteristics between sexes. Because we had data to directly estimate sex- and age-specific probabilities of breeding, fecundity, survival, brood sex ratios, and emigration rates, we could indirectly estimate age-specific immigration rates for both sexes. Our two-sex IPM revealed that population growth was most strongly associated with increased immigration and decreased first-year (FY) emigration in females but with after-first-year (AFY) survival in males. Most males that recruited as new breeders on our study area were AFY residents, whereas most female recruits were AFY immigrants. All females fledged on our study area that survived bred in their first year, whereas only 3% of FY males bred. We found evidence of density dependence in survival of AFY males ($r = -0.11$, 95% credible interval (CRI) = -0.36 – -0.03), but only marginal evidence of density dependence in AFY female immigration ($r = -0.02$, 95% CRI = -0.10 – 0.01). Our findings reveal that male and female Cooper's Hawks differ in their response to population density, and in how they contribute to population growth. Thus, sexual differences in vital rates can be an important consideration in raptor population models.