Seeing Spots: An SCR Model to Estimate Spatial and Temporal Variation in Fawn Survival and Recruitment

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In South Florida, white-tailed deer (Odocoileus virginianus) are an economically and culturally important game species. Deer populations in South Florida are unique due to their low density, low productivity, and wide window of reproductive activity [1]. The white-tailed deer is also the primary prey of the endangered Florida panther (Puma concolor coryi), which currently persists in a single population in South Florida [2]. Due to recently reported declines in South Florida deer populations, more information is needed about the factors influencing fawn survival and recruitment in this seasonally-inundated and predator-rich environment. We deployed 3 passive trail camera grids in the Florida Panther National Wildlife Refuge and Big Cypress National Preserve. Each 30 km² grid consisted of 60 cameras. We visually identified 123 unique fawns in 5200 fawn photos from December 1, 2015–June 30, 2016 and created a spatially-referenced capture history detailing each detection. We developed a novel spatial capture-recapture (SCR) model that uses capture histories to estimate population parameters such as birth rate, survival, and recruitment (180 days). Our model allows individual detection and survival probabilities to vary with fawn age and provides the ability to model spatiotemporal variation in birth rate and daily survival probability. We estimated the peak fawning date to be January 25th across this study site, with most fawning events occurring from January to March. Model estimates indicated that 208 fawns (95% CI 179-245) fawns were born within our camera grids during the 2016 fawning season, of which 37 individuals (95% CI 29-48) survived to 180 days (18%). We modeled fawn density, fawn detection probability, and daily survival rate as functions of environmental covariates including vegetation type, frequency of fire, seasonal water level changes, human activity and vehicle use, and the activity of potential fawn predators. Our goals were (A) to provide direct estimates of South Florida fawn survival and recruitment and (B) to elucidate which environmental variables had significant effects on fawn success in this landscape. We found that predicted fawn density significantly increased with frequent fire in an area, but decreased in open canopy vegetation types, such as marsh and prairie. Our model demonstrates a flexible, cost-effective, and non-invasive method for agencies and researchers to estimate fawn recruitment at broad spatial and temporal scales while addressing questions about the underlying birth and juvenile survival processes. We intend to make this innovative method accessible to other researchers for non-invasively studying population dynamics in a variety of target species.

References: