Mechanisms Influencing Pack Size in Gray Wolves

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Estimates of the abundance of gray wolves (*Canis lupus*) are important to Montana Fish, Wildlife and Park's (MFWP) Wolf Program. MFWP uses a Patch Occupancy Model (POM) to estimate area occupied, from which they estimate abundance based on average territory and pack size. Accordingly, abundance estimates depend on intensive field monitoring to estimate pack sizes. Pack size is driven by births, deaths, and the social decisions of group members, including if and when to disperse. Like many cooperatively breeding canids, gray wolves exhibit flexible and diverse dispersal behaviors. We aimed to better understand mechanisms influencing pack size and dispersal, and to develop a predictive tool for estimating pack size for wolves in Montana, absent data directly related to births and dispersals because these data will be unavailable to wildlife managers. We hypothesized that group sizes of cooperatively-breeding canids would be influenced by conditions related to prey, competition, and mortality risk. We found that wolf pack sizes in Montana were positively related to local densities of prey and packs, and negatively related to terrain ruggedness, local mortalities, and intensity of harvest management. A predictive model for pack sizes reliably estimated the mean annual pack sizes observed from 2005 - 2018 (adjusted R-squared = 0.58, $P < 0.002$) and illuminated possible underlying mechanisms influencing variation in pack sizes over space and time. Alongside a mechanistic territory model we developed for POM, our pack size model will help keep abundance estimates from POM calibrated into the future, absent intensive monitoring effort.