ASPECTS OF HUNTING ON NORTHERN BOBWHITE POPULATIONS: TEMPORAL AND SPATIAL ANALYSIS

A Dissertation

by

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ABSTRACT

Aspects of Hunting on Northern Bobwhite Populations: Temporal and Spatial Analysis

(December 2021)

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Northern bobwhites (*Colinus virginianus*) have been studied intensively now for more than a century. Despite the attention, widespread declines have occurred across their geographic ranges. These declines raise concerns regarding the long-term sustainability of populations exposed to hunting. However, population trends of northern bobwhites in South Texas seem to lack the long-term declines occurring across much of the state and elsewhere. Research has attributed this to favorable range management practices, large property sizes, and economic incentives derived from hunting lease fees in the region. The recommended harvest rate for South Texas is 20% of the fall abundance, including factoring for crippled individuals. This harvest rate is based on simulations of empirical data but still requires thorough evaluations in the field. We assessed the 20% recommendation during the 2018–2019, 2019–2020, and 2020–2021 hunting seasons on East Foundation properties in Jim Hogg County, Texas, using designated hunted (15,030 acres) and non-hunted sites (10,813 acres). We estimated multi-temporal bobwhite densities (e.g., 4 per hunting season × 3 seasons) using line-transect distance sampling from a helicopter platform and recorded bobwhite hunting details using Garmin GPS units (i.e., trucks and pointing dogs) and detailed hunting logs. Our specific objectives were to (1) evaluate the harvest rate recommendation for northern bobwhite populations in South Texas

by comparing temporal trends between hunted and non-hunted sites (Chapter 2), (2) analyze the temporal and spatial dynamics of quail hunts in South Texas (Chapter 3), and (3) evaluate the spatial effects of harvest-related hunting pressure on local distributions of northern bobwhites (Chapter 4). According to our bobwhite density estimates, spring densities on both sites (e.g., hunted vs. non-hunted) were similar through the first two years but diverged in 2020–2021, with bobwhite densities 129% higher on the non-hunted site (Chapter 2). Hunting parties effectively covered 23.8 ± 0.3 hectares per hour, with hunts lasting 3.5 ± 0.1 hours in the morning and 1.7 ± 0.1 hours in the evening (Chapter 3). We also found that hunting pressure associated with a 20% harvest (i.e., low hunting pressure; 5.3–8.3-gun hours/100 ha) has a minimal influence on the change in bobwhite density at 16 ha resolution, with the year (i.e., starting or peak density per year) as the primarily influence (Chapter 4). Our results will assist managers in making decisions regarding sustainable harvest practices and aid with the strategical distributions of hunting pressure across properties and hunting seasons.

DEDICATION

I dedicate this dissertation to my family, who have supported me during this journey. Sofia, I am forever grateful for the support and sacrifices you have made over the last 9 years. I would not have been able to tackle the challenges of work and school without your steady encouragement and confidence in me. I look forward to the adventures God has in store for us. To my sons, Beau and Dylan, you may not realize it now, but all the nights, weekends, and summers I have spent working are to provide a better future for you. There is nothing in this world I enjoy more than being with you. You both are intelligent, strong, and have the biggest hearts; you can do anything you set your mind to. I love you both and your momma dearly. Dad and Deb, thank you for instilling in me a deep passion for the outdoors and teaching me that I can accomplish anything through hard work. Mother and Grandma, thank you for all your support and prayers. I could not have done this without all your help, thank you.

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CHAPTER 1.
PROJECT BACKGROUND AND OBJECTIVES

BACKGROUND

Northern bobwhite (*Colinus virginianus*) populations have been declining across their geographic range for nearly 100 years (Stoddard 1936: xxi, Brennan 1991, Guthery 2002:4, 5). Researchers have attributed these downward trends to the widespread changes in land-use practices over time (Roseberry and Klimstra 1984: 194, Brennan 1991, Brennan et al. 2007b). There are, however, a few areas within the northern bobwhite geographic range that have maintained relatively abundant populations through the years. The South Texas Plains ecoregion has maintained a stable long-term bobwhite population, despite annual fluctuations (Peterson and Perez 2000). In South Texas, an alignment of favorable range management practices, large ranches that provide millions of acres of habitat that support bobwhite populations, and economic incentives such as fee-lease hunting that support sustained management (Brennan et al. 2007b, Hernández and Guthery 2012). The South Texas Plains is considered a National Legacy Landscape for Northern Bobwhite Conservation, and as such, is one of the last great places for quail in North America. A primary concern for landowners, wildlife managers, and sportsmen across the nation is the continued viability of huntable quail populations (Brennan 2007a).

Generally, quail harvest tends to fluctuate with annual abundance (Stoddard 1936:13, Vance and Ellis 1972, Peterson and Perez 2000, Palmer et al. 2002). Nevertheless, harvest at local scales tends to remain constant when populations are low (Guthery et al. 2004a). This occurs during years when the primary hunters in the field are avid quail hunters (Guthery et al. 2004a), who spend more time in the field and harvest more quail annually than the average quail hunter (Hurst et al. 1982). State game agencies regulate quail harvest; however, enforced regulations (e.g., bag limits and season lengths) are not designed for management at local scales (Peterson and Perez 2000, Guthery et al. 2004b, Tomećek et al. 2015). Harvest within the legal guidelines can significantly impact breeding densities at local scales and population viability (Sands et al. 2012).

Several studies have investigated the impacts of bobwhite harvest at local levels, revealing a mixture of results due to issues such as poor experimental design (e.g., lack of controls, accounting for egress and ingress), unreliable population estimates (e.g., using indices rather than density), the temporal and spatial scale of study (e.g., years, acreage), and the inability to control the timing and rate of harvest (Burger et al. 1994, Guthery 2002). Furthermore, harvest recommendations have varied from 0% to 70% of the fall populations (Guthery et al. 2000). Stoddard (1931:226,341) suggested a harvest rate between 0% and 50% depending on environmental conditions and the control of predators. Rosene (1969:206,346) recommended a maximum harvest of 45% in the southeastern United States. Vance and Ellis (1972) suggested that a 70% harvest in Illinois was sustainable. Using population simulations, Roseberry (1979) found spring population reductions were modest up to a 40% harvest threshold. Models by Guthery et al. (2000) and Sands (2010) concluded that a 20-25% harvest was sustainable in South Texas. These studies simulated population responses to various harvest rates and stochastic environmental conditions against quasi-extinction criteria (Roseberry and Klimstra 1984: 146, 175, Guthery et al. 2000, Sands 2010).

Currently, Brennan et al. (2014) recommends a 20% harvest for South Texas bobwhite populations. This figure includes a correction rate for birds lost in the field and crippled (Guthery et al. 2000, Sands 2010, Brennan et al. 2014). This recommendation is based on simulation analyses of demographic data collected from wild bobwhites that still need empirical evaluation. (Reed et al. 1998, Guthery 2002:114, Brennan 2002).

OBJECTIVES

This study was designed to examine the temporal and spatial effects resulting from the application of the 20% harvest rate across the statewide hunting season (e.g. 115 ± 5 days). Specifically, the objectives were:

1. Collect multi-temporal (i.e., 4 surveys per year x 3 years) density estimates across hunting seasons using line-transect distance sampling from a helicopter platform, which would include pre-hunting and post-hunting abundance estimates;
2. Prescribe 20% harvest quotas for hunted site based on November (i.e., pre-hunting) abundance estimate to be distributed spatially by pasture densities and monthly across legal hunting seasons;
    a. Determine the feasibility of a 20% harvest application, consisting of 16% retrieved and 4% assigned crippling loss based on the fall density estimate;
3. Compare population trends across months, seasons, and years between hunted and non-hunted populations, and against simulated results;
4. Analyze the spatial and temporal dynamics of quail hunts in South Texas;
    a. Distribute harvest prescriptions temporally across hunting seasons and spatially across pasture;
    b. Assess hunting efficiency between hunting season periods: (1) early period (November to mid-December), (2) middle period (mid-December to late January), and (3) late period (late January to early March); and

5. Determine the function of hunting pressure on changes in localized distributions;

    a. Construct bobwhite density surface models from each line transect survey ($n = 12$ surveys) and calculate density trends at the resolution of a bobwhite winter home range (16 ha) across seasons and individual periods within years;

    b. Assess the influence of bobwhite hunting variables (i.e., harvest, hunts, gunshots) to changes in bobwhite density and distribution.

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