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Is Quail Hunting Self-Regulatory? Northern Bobwhite and Scaled Quail Abundance and Quail Hunting in Texas

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IS QUAIL HUNTING SELF-REGULATORY? NORTHERN BOBWHITE AND SCALED QUAIL ABUNDANCE AND QUAIL HUNTING IN TEXAS

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ABSTRACT

Wildlife managers often maintain that quail hunting is self-regulatory because they assume hunters spend fewer days hunting, and bag fewer quail per day, when hunting is "poor," while hunting more frequently, and bagging more quail per day, when hunting is "good." For this reason, managers conclude that minor changes in hunting season length and bag limit are inconsequential. We used August quail abundance (1978–1996) and harvest (1981–1983, 1986–1996) data collected by Texas Parks and Wildlife Department biologists to test the "self-regulatory" hypothesis for both northern bobwhites (*Colinus virginianus*) and scaled quail (*Callipepla squamata*). First, we tested the hypothesis that quail abundance in August was sufficient to account for the total number of quail bagged by hunters during the subsequent hunting season. We then tested the hypotheses that quail abundance could predict: (1) the number of days people hunted quail; (2) the number of quail bagged per hunter per day; and (3) the number of quail hunters during the subsequent hunting season. Quail abundance in August was correlated with the number of northern bobwhite and scaled quail bagged during the following hunting season (r^2 = 0.769 and 0.874, P <0.0005, respectively). Texas hunters typically hunted quail about 2.5 to 3 days annually regardless of quail abundance. Quail abundance in August, however, was correlated with the number of quail bagged per hunter per day and the number of quail hunters during the subsequent hunting season (northern bobwhite: r^2 = 0.895 and 0.868, P <0.0005, respectively; scaled quail: r^2 = 0.833 and 0.740, P <0.0005, respectively). These results are consistent with the hypothesis that both northern bobwhite and scaled quail abundance can regulate quail hunting effort and success within the framework of the hunting regulations that have been in effect in Texas since the early 1980's.

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INTRODUCTION

It has long been recognized that northern bobwhite (*Colinus virginianus*) abundance typically fluctuates considerably among years over much of this species' range (Stoddard 1931:339–347, Rosene 1969:194–197, Schwartz 1974, Snyder 1978). Roseberry and Klimstra (1984:151–91) argued that fluctuations observed in northern bobwhite density on their research area in southern Illinois were cyclic. Similar fluctuations also have been noted for scaled quail (*Callipepla squamata*) in New Mexico (Campbell et al. 1973). In Texas, both northern bobwhite and scaled quail abundance fluctuates substantially among years (Figure 1). Additionally, there is apparent synchrony in quail abundance among the 6 Texas ecoregions (Gould 1975) where data were consistently collected since 1978 (Figure 2). This suggests that certain environmental factors act at a sufficiently broad spatial scale to influence quail abundance over much of Texas at roughly the same time.

In the past, many states, including Texas, attempted to use hunting regulations to decrease the number of quail harvested during periods of low abundance and increase harvest when quail were plentiful. The basic assumption underlying these efforts was that winter cover was inadequate to protect fall populations, so the number of quail above some threshold quantity was either lost to predation or dispersed (Errington 1934). Thus, the number of quail above this threshold were "surplus" and could be harvested by humans with no detriment to the spring breeding density or population viability. Consequently, some states reduced bag limits and/or season lengths when surveys indicated low quail abundance, and attempted to predict when high densities might occur, then subsequently increased bag limits and season lengths accordingly. This was a difficult task. For example, if fluctuations in Texas quail abundance among years (Figures 1–2) are primarily controlled by precipitation patterns, as suggested by Campbell et al. (1973:34–36), Kiel (1976), and Giuliano and Lutz (1993), then Texas Parks and Wildlife Department staff would find it difficult to accurately predict precipitation far enough in advance to use this information when setting hunting regulations (regulations typically are set 6 months be-

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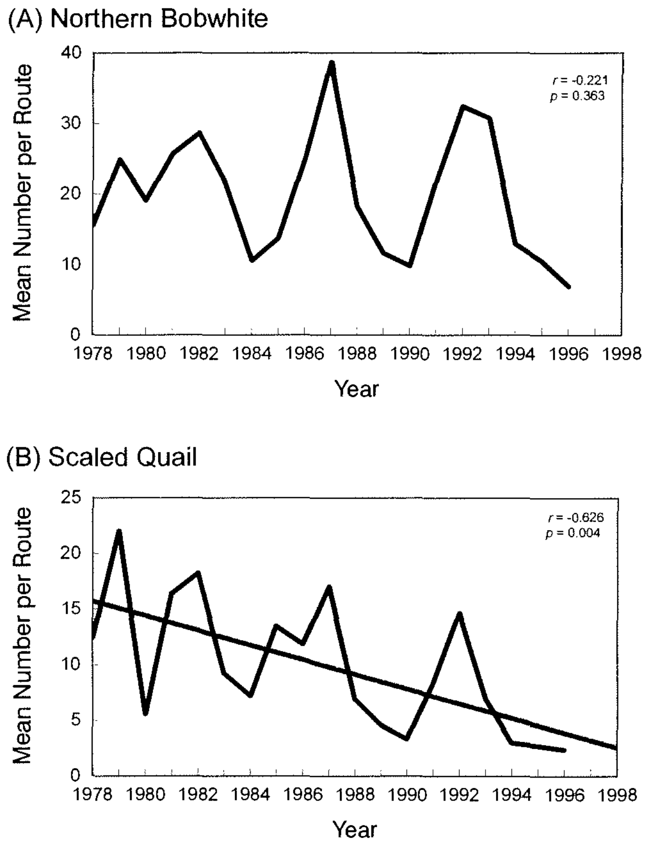

Fig. 1. Mean number of (A) northern bobwhites and (B) scaled quail counted annually per 20-mile (32.2 km) roadside survey route in Texas, 1978–1996 (Perez 1996; data from the Gulf Prairies, Cross Timbers, South Texas Plains, Edwards Plateau, Rolling Plains, and Trans-Pecos ecological areas [Gould 1975]).

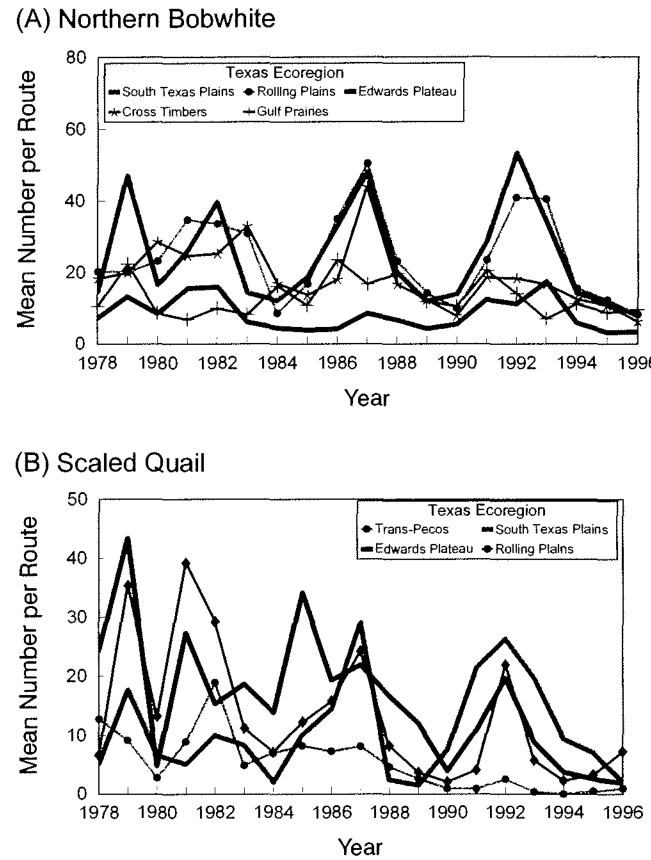

Fig. 2. Mean number of (A) northern bobwhites and (B) scaled quail counted annually per 20-mile (32.2 km) roadside survey route among each of 6 Texas ecological areas, 1978–1996 (Perez 1996).

fore the hunting season opens). Further, Roseberry (1979) predicted that, even if accurate estimates of quail production could be made sufficiently far in advance to vary hunting season length with quail abundance, only meager gains toward optimizing sustained yield harvest would be made.

In many states, including Texas, managers no longer attempt to compensate for fluctuations in quail abundance by altering statewide annual hunting season length or bag limits. This change in policy occurred for 3 reasons: First, managers typically assume that quail hunting intensity and success are largely self-regulatory, making micromanagement of the quail hunting season length and bag limit, at the statewide scale at least, unnecessary (Roseberry and Klimstra 1984:149). They assume that hunters spend fewer days hunting, and bag fewer quail per day, when hunting is "poor," while hunting more frequently, and bagging more quail per day, when hunting is "good." For example, Guthery (1986:153) argued that when quail densities are low and hunting success poor, hunters soon quit hunting—effectively closing the hunting season. Second, managers have realized that fine-grained management of quail harvest can only be accomplished by people who manage tracts of land where quail are hunted (Lehmann 1984:303, Roseberry and Klimstra 1984:149, Brennan and Jacobson 1992, Peterson 1996). Third, recent studies have demonstrated that northern bobwhite harvest is not completely compensatory (Curtis et al. 1989, Pollock et al. 1989, Robinette and Doerr 1993) and may become increasingly additive to other forms of mortality the later in the season harvest occurs (Roseberry and Klimstra 1984: 139–150). These observations call into question Errington's (1934) model of harvest theory. Strategies based on sustained yield are gaining more widespread acceptance (Roseberry 1982, Robertson and Rosenberg 1988, Brennan and Jacobson 1992, Caughley and Sinclair 1994:279–290). Moreover, Guthery (1996) argued that the fuzzy logic implicit in the additive versus compensatory harvest construct is detrimental to sound management of quail harvest and has confused the public and biologists alike. Therefore, because the relationship between hunting and the number of quail available to breed the next season is unclear, many managers maintain that data are insufficient as a basis for micromanagement of statewide hunting regulations.

Although researchers have addressed, to some degree, whether hunting-induced mortality is additive to other sources of quail mortality, the notion that quail hunting effort and success are self-regulatory has received little critical attention. Therefore, we used long-term quail abundance and harvest data collected by

Texas Parks and Wildlife Department biologists to test this hypothesis for both northern bobwhite and scaled quail hunting in Texas. Specifically, we tested whether quail abundance (as measured in August), can account for: (1) the total number of quail bagged; (2) the mean number of days people hunted quail; (3) the mean number of quail bagged per hunter per day; and (4) the total number of quail hunters during the subsequent hunting season.

METHODS

Data

Quail population trends in Texas have been monitored since 1978 using randomly selected, 20-mile (32.2 km) roadside survey lines (see Perez [1996] for the development of this technique and details of its application). Currently, 158 survey lines (20 miles each) are located in the Gulf Prairies, Cross Timbers, South Texas Plains, Edwards Plateau, Rolling Plains, High Plains, and Trans-Pecos ecological areas (Gould 1975). These routes were sampled once each August by Texas Parks and Wildlife Department biologists, either at sunrise (E to W) or 1 hour prior to local sunset (W to E). Typically only 1 to 3 biologists have run a given route over the duration of the survey. The lines were driven at 20 miles/hour (32.2 km/hour) and all quail observed were recorded by species for each 1-mile (1.6 km) interval. The number of young per brood and approximate brood age were also recorded. Because routes were not consistently run in the High Plains ecological area, these data were not included in our analyses. Northern bobwhites do not occur in the Trans-Pecos Ecological Area, while scaled quail do not inhabit the Gulf Prairies or Cross Timbers.

Quail harvest trends in Texas were determined for 1981–1983 and 1986–1996 as part of the annual Small Game Harvest Survey conducted by the Texas Parks and Wildlife Department (TPWD 1996). This survey was mailed annually to 15,000 randomly selected individuals holding a Texas hunting license. Survey questions included the species hunted, total number bagged, number of days spent hunting, and Texas county where the person hunted each species most often. Non-respondents were mailed a second and third notice for an overall mean response of 52.2%. When first implemented, the survey was mailed to both Texas residents and nonresidents. No differences were noted between the responses of these 2 groups so the survey was mailed to residents only during recent years. For the duration of the survey, the number of respondents hunting northern bobwhites and scaled quail ranged from 833 to 2,013 ($\bar{x}$ = 1,483) and 216 to 649 ($\bar{x}$ = 468), respectively.

The number of quail harvested per hunter and the number of days each hunter spent hunting quail exhibited a negative binomial distribution. Therefore, these data were arcsin transformed prior to further analysis. Regression analysis of responses to each of the 3 mailings (original survey plus the 2 reminders) was used to estimate these values for non-respondents (Armstrong and Overton 1977), thus correcting for the non-response bias associated with the survey technique. The total number of quail harvested and quail-hunter days were estimated by expanding the mean number of quail bagged per hunter by the estimated number of quail hunters. The number of quail harvested per hunter per day was obtained by dividing the estimated quail harvest by the number of quail-hunter days. Results were separately tabulated for both northern bobwhite and scaled quail by Texas ecological area (Gould 1975) and published in the annual Small Game Harvest Survey (TPWD 1996).

During the 1981–1982 and 1982–1983 quail hunting seasons, the County Commissioner's courts in Texas had authority to reject any regulatory changes proposed by the Texas Parks and Wildlife Department if they chose to do so. Consequently, bag limits ranged from 12 to 20 birds and possession limits from 36 to 60. In all but 1 Texas county, the quail hunting season opened between 31 October and 1 December and closed between 31 January and 15 February (exception: 15 October through 15 December). Because these bag and possession limits and season dates are similar to those used in later years (statewide: 15, 45, and Saturday nearest 1 November to last Sunday in February, respectively) we included all years in our analyses.

Analysis

If quail-hunting intensity and success are regulated by quail abundance in Texas, then one would expect that the mean number of quail observed per survey line in August should be sufficient to account for the total number of quail bagged by hunters during the subsequent hunting season. If this hypothesis is supported by data, then 1 or more of the following should be true: the mean number of quail observed per route in August should predict the (1) mean number of days hunters spent hunting quail; (2) number of quail bagged per hunter per day; and/or (3) number of people hunting quail during the subsequent hunting season. The last hypothesis may be more pertinent in Texas, where paying a fee for access to quail hunting areas is well established (Adams and Thomas 1983, Adams et al. 1992) than in some other states. Because we did not want to overlook any long-term trends in quail abundance, we also determined whether there was a trend in either northern bobwhite and scaled quail abundance over time.

We tested each of these hypotheses for both northern bobwhites and scaled quail using regression analyses (Wilkinson et al. 1992). The independent variable for each analysis was the mean number of quail observed per survey route (Perez 1996) for the Gulf Prairies, Cross Timbers, South Texas Plains, Edwards Plateau, Rolling Plains, and Trans-Pecos ecological areas of Texas (Gould 1975). The total number of quail harvested annually, the mean number of days each hunter spent hunting quail, the mean number of quail bagged per hunter per day, and the total number of people hunting quail (TPWD 1996) also were limited to these

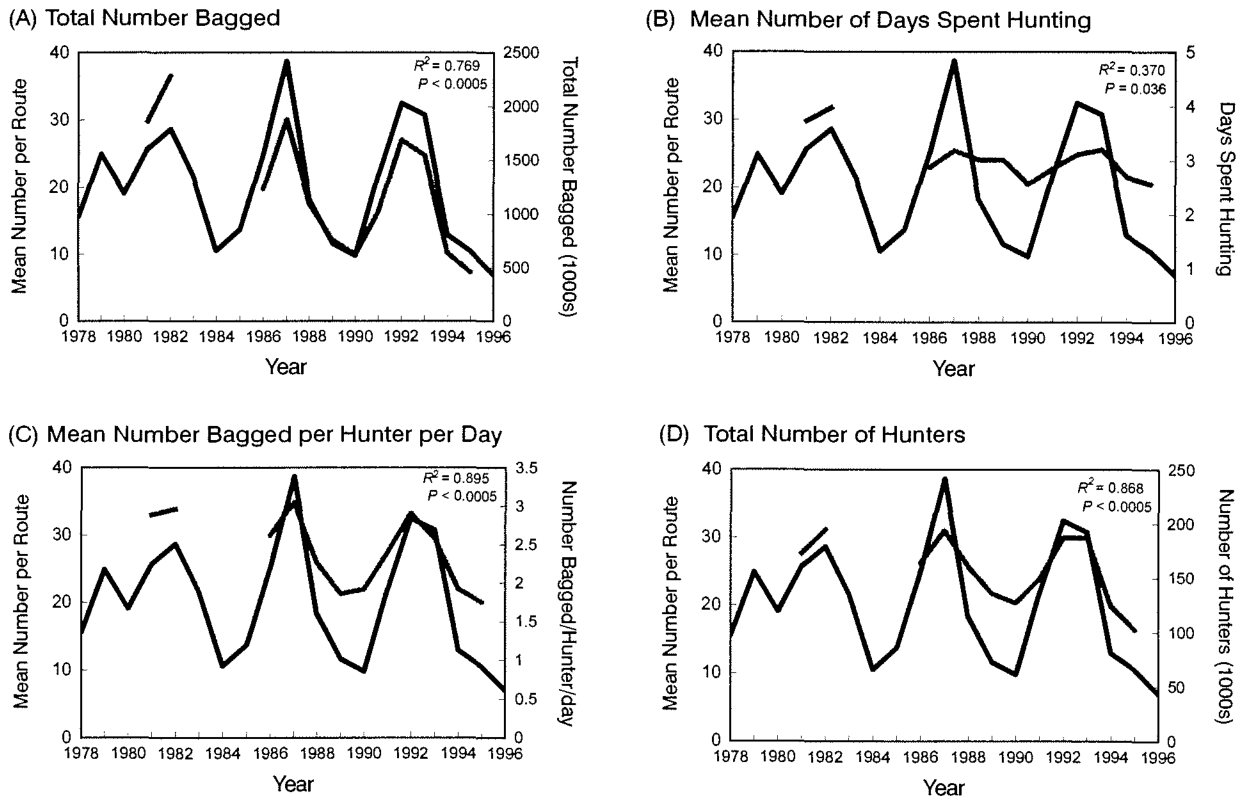

Fig. 3. Mean number of northern bobwhites counted annually per 20-mile (32.2 km) survey route in 5 Texas ecological areas shown in Figure 2A, 1978–1996 (solid line) and the estimated (A) total number of northern bobwhites bagged, (B) mean number of days each hunter spent hunting northern bobwhites, (C) mean number of northern bobwhites bagged per hunter per day, and (D) number of license holders who hunted northern bobwhites in these ecological areas (stippled lines), 1981–1983 and 1986–1996 (Perez 1996, TPWD 1996).

same ecological areas. Residual plots indicated that no further data transformations were necessary. We conducted all statistical analyses at the $P < 0.05$ level of significance.

RESULTS AND DISCUSSION

Rangewide quail abundance in Texas, as determined from August roadside counts, was sufficient to account for the total number of northern bobwhites and scaled quail harvested (Figures 3A and 4A; $R^2 = 0.769$ and 0.874, $P < 0.0005$, respectively) and the mean number of northern bobwhites and scaled quail bagged per hunter per day (Figures 3C and 4C; $R^2 = 0.895$ and 0.833, $P < 0.0005$, respectively). These results are similar to those reported by Schwartz (1974) during his 9-year study of northern bobwhite abundance (determined from August roadside counts) and harvest for Iowa. Similarly, Wells and Sexson (1982) reported that northern bobwhite abundance (number recorded by rural mail carriers per 100 miles [160.9 km]) in July or October (1962–1980) could predict both the total number of quail harvested in Kansas and the average daily bag. These data support the idea that quail abundance, as estimated by roadside surveys, can predict the number of quail harvested during the following hunting season at the statewide scale, at least in Texas, Iowa, and Kansas.

Although quail abundance in August was significantly related to the number of days people spent hunting northern bobwhites and scaled quail during the subsequent hunting season, these fluctuations were relatively small (Figures 3B and 4B; $R^2 = 0.370$, [$P = 0.036$] and 0.706 [$P = 0.001$], respectively). In essence, the average Texas quail hunter spent 2.5 to 3 days hunting quail annually regardless of quail abundance. We assumed, as did Guthery (1986:153), that Texas hunters would spend substantially fewer days hunting quail during years when quail abundance was relatively low. It appears, however, that the hypothesis that the quail hunting season in Texas is effectively closed when hunting is poor may still be tenable, but for a different reason. When quail abundance was low, substantially fewer people hunted northern bobwhites and scaled quail at all during the subsequent hunting season (Figures 3D and 4D; $R^2 = 0.868$ and 0.740, $P < 0.0005$, respectively). For example, during the quail peak seasons of 1982–1983, 1987–1988, and 1992–1994, an estimated mean of 187,189 people hunted northern bobwhites and 65,964 hunted scaled quail. Conversely, during the poor quail years of 1989–1990 and 1994–1995, only a mean of 122,157 and 37,680 people hunted northern bobwhites and scaled quail, respectively—a 34.7 and 42.9% decrease. Thus the quail season was effectively closed for a substantial proportion of quail hunters in Texas. The fee hunting system

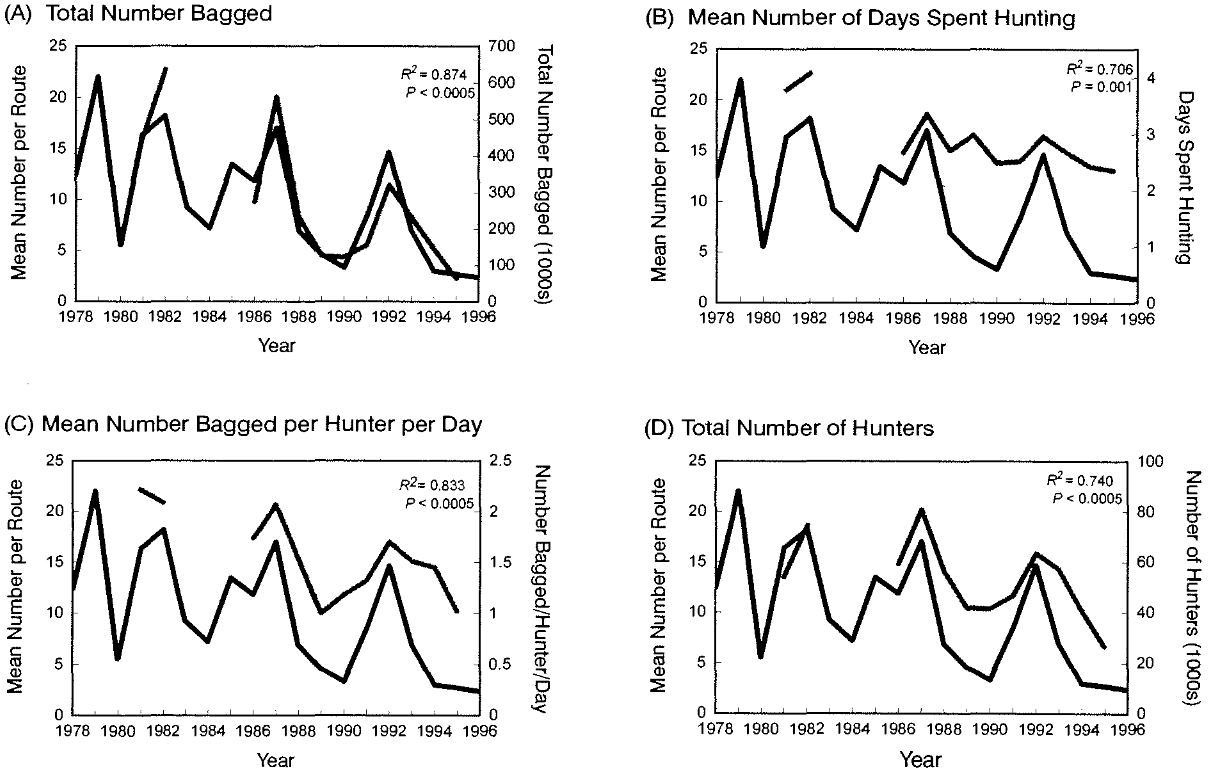

Fig. 4. Mean number of scaled quail counted annually per 20-mile (32.2 km) survey route in 4 Texas ecological areas shown in Figure 2B, 1978–1996 (solid line) and the estimated (A) total number of scaled quail bagged, (B) mean number of days each hunter spent hunting scaled quail, (C) mean number of scaled quail bagged per hunter per day, and (D) number of license holders who hunted scaled quail in these ecological areas (stippled lines), 1981–1983 and 1986–1996 (Perez 1996, TPWD 1996).

in Texas (Adams and Thomas 1983, Adams et al. 1992) may be part of the reason quail abundance influences fluctuations in quail-hunter numbers. It could be that, if a successful hunt appears unlikely, fewer hunters purchase access to quail hunting areas, while those who do pay for admittance hunt quail regardless of their abundance. Consequently, caution should be used in applying these results in other regions.

We observed that scaled quail abundance in Texas has declined significantly since 1978 (Figure 1B). Church et al. (1993) reported similar results for Texas and the remainder of this species' range in their evaluation of North American Breeding Bird Survey data. Conversely, our data did not show evidence of a long-term decline in northern bobwhite abundance for the composite Texas ecological areas we evaluated (Figure 1A). Brennan (1991), using Christmas Bird Count data, also observed no decline in northern bobwhite abundance in Texas. These results contrast sharply with most of the southeastern United States, where northern bobwhite abundance has declined during the last 30 years (Brennan 1991, Church et al. 1993). Texas Parks and Wildlife Department harvest data, however, suggest that northern bobwhite abundance in the Pineywoods Ecological Area, where habitat conditions are similar to the rest of the southeastern United States, has declined during this period. Because our northern bobwhite data were collected from relatively robust populations, one must be cautious in extrapolating our results to other parts of this species' range.

Although our data are consistent with the hypothesis that quail hunting is self-regulatory, we could not address how statewide changes in hunting regulations influence the number of quail harvested in Texas. As Roseberry (1979) predicted, it appears unlikely that relatively small regulatory changes would substantially alter the number of quail surviving after the hunting season (Figures 3–4). For example, because the typical person hunting northern bobwhite in Texas bags between 4 and 12 quail per season (depending on the year), and hunts quail 2.5 to 3 days, decreasing the daily bag limit by 2 birds (currently 15), and/or the season length by a week (currently 118 days), would be unlikely to influence the total number of birds bagged. Similarly, because our study was conducted at a statewide scale, we cannot address how small changes in the statewide daily bag limit and/or season length would influence the number of quail bagged, or the number of quail available to breed the following season, on a single, intensely-hunted pasture (Brennan and Jacobson 1992). However, during his 6-year study, Synder (1978) found that changes in season length and bag limit (ranging from 19 to 33 days and 6 to 8 birds) had little influence on the number of northern bobwhite harvested on his intensely hunted study area in eastern Colorado (1,623 ha of quail habitat). To address how more draconian changes in statewide quail hunting regulations might influence hunter effort and success would require experimental manipulation. Whether an experiment could be designed to yield statistically reliable results that could be extrapolated to the entire state of Texas, while remaining politically palatable, is open to question.

This study did not address the degree that hunting-induced mortality is additive to other forms of quail mortality, nor how variations in the statewide bag limit, hunting season length, and/or season timing influence this relationship. If we are to move away from the fuzzy logic implicit to the additive versus compensatory construct of quail-harvest theory to a model based on sustained yield harvest management (Roseberry 1979, 1982; Brennan and Jacobson 1992; Guthery 1996), experimental manipulations will be needed to determine the influence of hunting regulations on the number of quail available to breed during the next reproductive season. Because fine-grained management of quail harvest is best accomplished by those managing the tracts of land where quail are hunted (Lehmann 1984:303, Roseberry and Klimstra 1984: 149, Peterson 1996), we join Brennan (1991), Burger et al. (1994), and Burger et al. (1995) in calling for studies designed to determine the effect of harvest timing and intensity on the number of quail available to breed the next season at this fine-grained spatial scale.

SUMMARY AND IMPLICATIONS

Quail abundance, as determined by August roadside counts in Texas, was sufficient to account for the total number of northern bobwhite and scaled quail harvested, the mean number bagged per hunter per day, and the number of quail hunters during the subsequent hunting season. These data support the notion that Texas quail hunting, at the statewide scale, is regulated by quail abundance within the framework of the hunting regulations in effect since the early 1980's. Therefore, it is unlikely that small, statewide changes in the hunting season length or daily bag limit will significantly influence the number of quail available to breed during the next reproductive season. We have insufficient data, however, to address how substantial, statewide changes in hunting regulations influence hunter effort and success or the number of quail surviving until the following reproductive season. Similarly, additional research must be conducted to determine how hunting pressure influences reproductive numbers at the fine scale (pastures) where harvest management is best conducted.

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