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# SURVIVAL OF NORTHERN BOBWHITES ON AREAS WITH AND WITHOUT LIBERATED BOBWHITES

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## ABSTRACT

Increases in pen-raised quail releases are often implicated in the precipitous region-wide decline of wild northern bobwhites (*Colinus virginianus*). Therefore, we compared survival rates of wild radio-tagged northern bobwhites on a study area that received an influx of liberated pen-raised bobwhites from a neighboring property to those of wild bobwhites on a control area during 3 years in southwest Georgia. A total of 302 radio-tagged wild bobwhites were monitored on the wild-release (113) and wild-only areas (189) for a 22 week period from fall to spring each year during November 1993–April 1996. Fall-spring survival of wild bobwhites on the wild-only area ( $S = 0.43$ ) was greater ( $P = 0.005$ ) than that of wild bobwhites on the wild-release area ( $S = 0.18$ ) for the 3 years combined. Losses to avian predation accounted for 38% and 58% of the fall population, respectively. Increased avian predation on the wild-release area may have been attributed to avian predators attracted to the area.

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## INTRODUCTION

Liberation of pen-raised bobwhites prior to or during the hunting season is a common practice in the southeastern U.S. (Kozicky 1987, Landers et al. 1991, DeVos and Speake 1995). Much debate has occurred over whether this practice has contributed to or is in response to the decline in wild bobwhites over the past several decades. There are many concerns about possible effects that releasing pen-raised bobwhites might have on wild bobwhite populations (Landers and Mueller 1986, Landers et al. 1991, Hurst et al. 1993). Several possible negative effects have been suggested including disease transmission, genetic pollution, and increased mortality of wild birds (Brennan 1991, Landers et al. 1991, Hurst et al. 1993, Mueller et al. 1993); however, none of these topics have been thoroughly researched.

Landers et al. (1991) identified several high priority research topics which included effects of pen-raised bird releases on predator-prey relationships of wild birds. One of the suggestions in the Strategic Plan For Quail Management and Research in the United States (Hurst et al. 1993) was to “perform field research on predation rates of quail in a variety of experimental situations ranging from wild populations with no released birds to populations that have been subjected to extensive release of pen-raised quail.” A

recent study in Alabama (DeVos and Speake 1995) addressed this topic and concluded that slight increases in wild bird mortality could be expected; however, these differences were not statistically significant. These same authors concluded that the effects of pen-reared releases on wild bird predator-prey relations deserved further research.

As a follow up to that study, we took advantage of a “natural experiment” and examined survival of wild bobwhites on two areas, one with no liberated birds and a second that annually experienced an influx of liberated birds. Mortality rates of radio-tagged wild bobwhites were compared on an area that received an influx of pen-raised birds from a neighboring property to those on a control area where there were no pen-raised bobwhites. Our objectives were to determine if this influx of pen-raised birds had any effect on predation rates and fall-spring survival of wild birds.

## STUDY AREA AND METHODS

This study was conducted on Nilo Plantation in Baker and Dougherty Counties, Georgia. Nilo is a 4,490 ha privately owned wild bobwhite hunting property located in the heart of southwest Georgia’s plantation community near the city of Albany. The property has been under intensive bobwhite management

for 50 years and supports an abundant population of wild bobwhites.

The habitat is maintained as a mixture of frequently burned, low basal area pine (*Pinus* spp.) woodlands, live oak (*Quercus virginiana*) savannahs, patch agricultural plantings, and open fields. Field system management consists of rotational agricultural plantings and fall disking to stimulate annual weed production and insects. A detailed description of Nilo can be found in Simpson (1976).

Two separate hunting courses were used as study areas. The area influenced by the pen-raised bird release (wild-release) was a 380 ha hunting course on the north end of the property. This area was bordered on one side by a public highway just across from a relatively small (500 ha) private property where extensive pen-raised bird releases were conducted prior to and during hunting season. The control area (wild-only) was a 316 ha hunting course on the south end of the property that was surrounded by wild quail land. The wild-only area was approximately 2 km from both the wild-release area and the property where the birds were released.

Wild bobwhites were trapped and released on both study areas during October–November of 1993–1995 using standard, baited funnel traps (Stoddard 1931). All captured birds were aged, sexed, weighed, and leg-banded. Each fall approximately 40 wild quail on each site that weighed >130g were chosen to be marked with radio-transmitters. Additional bobwhites were captured and radio-tagged as needed through the winter and early spring. We used a 6 g neck-loop mounted transmitter equipped with an activity switch (Holohil Systems Ltd., Ontario, Canada). All radio-tagged and/or banded birds were released at their capture site. Each radio-tagged bobwhite was located and checked for activity 2 to 3 times per week from capture until covey break-up in mid-April. Routine hunting was conducted on both study areas approximately once every 2 weeks. Specific causes of non-hunting mortality were determined, when possible, by evidence at the kill site and condition of the transmitter (Curtis et al. 1988).

In each of the 3 years studied, the wild-release study area was influenced by the release of a large number of pen-raised birds. These consisted of a large pre-season release (approximately 2,000 to 3,000 pen-raised bobwhites) and some subsequent smaller releases (200 to 500) during the hunting season. The exact timing and number of birds released is not known. Large numbers of these liberated birds were observed each year on the portion of Nilo adjoining this property (wild-release study site) by our staff as well as Nilo personnel. In 2 of the 3 years, the pen-raised bird release had not occurred prior to our trapping effort, and in the third year the recently released liberated birds were easily distinguishable due to their size, behavior, and vocalizations. No released birds were observed on the wild-only area.

Survival estimates for the wild radio-tagged birds on both areas for the 22-week period from capture to covey break-up were estimated using the Kaplan-

Table 1. Kaplan-Meier survival estimates for radio-tagged bobwhites on a wild-only and pen-raised quail influenced (wild-release) study area in southwest Georgia, November–April, 1993–1996.

Year	Study area	N	Survival	95% CI
1993–94	Wild only	63	0.482 <sup>a</sup>	0.376–0.588
	Wild-release	43	0.183	0.060–0.306
1994–95	Wild only	74	0.349	0.267–0.431
	Wild-release	40	0.222	0.086–0.358
1995–96	Wild only	52	0.316 <sup>a</sup>	0.226–0.404
	Wild-release	30	0.100	0.017–0.183
1993–96	Wild only	189	0.430 <sup>a</sup>	0.370–0.490
	Wild-release	113	0.180	0.110–0.250

<sup>a</sup> Indicates survival rates were greater ( $P < 0.05$ ) than on the wild-release area.

Meier staggered entry design (Kaplan and Meier 1958, Pollock et al. 1989), which allowed for inclusion of additional birds during the study and censoring due to radio failure or emigration. Mortalities that occurred within 1 week of radio attachment were not used in the analysis (Robinette and Doerr 1993). Comparisons of survival curves between years and among groups were done using log-rank tests (Pollock et al. 1989). All tests were conducted at the  $P < 0.05$  level.

## RESULTS

We monitored 302 radio-tagged bobwhites from November to mid-April from 1993 to 1996. This included 113 bobwhites on the wild-release area and 189 on the wild-only area. Log-rank tests indicated no significant differences in survival curves between the 3 years on the wild-release area ( $P = 0.51$ ) or the wild-only area ( $P = 0.47$ ); therefore, data for all 3 years were combined for each study area. During the 1993–94 season, estimated fall-spring survival was greater ( $P < 0.005$ ) on the wild-only area ( $S = 0.482$ ) than on the wild-release area ( $S = 0.183$ ) (Table 1). During 1994–95, fall-spring survival was again higher on the wild-only area ( $S = 0.349$ ) than on the wild-release area ( $S = 0.222$ ); however, this difference was not significant ( $P = 0.066$ ). During the 1995–96 season, fall-spring survival was again significantly greater ( $P = 0.043$ ) on the wild-only area ( $S = 0.32$ ) than on the wild-release area ( $S = 0.10$ ). For the 3 years combined, fall-spring survival of wild bobwhites was greater ( $P < 0.005$ ) on the wild-only area ( $S = 0.43$ ) than on the wild-release area ( $S = 0.18$ ).

Predation was the leading cause of mortality on both study areas accounting for the mortality of 42% and 69% of the bobwhites on the wild-only and wild-release area, respectively. Avian predators were responsible for most (69%) of the known predation mortalities on both areas. Harvest of radio-tagged birds was not different ( $P = 0.84$ ) on the 2 sites, averaging 12.7% on the control area and 11.2% on the wild-release area.

## DISCUSSION

Wild bobwhites on our study area that adjoined a pen-raised bobwhite release area and were invaded

with large numbers of liberated pen-raised quail experienced significantly higher fall-spring mortality than their counterparts on an area where no pen-raised birds were observed. An earlier study on this topic (Sexson and Norman 1972) concluded native quail were lost at a higher rate on areas where pen-raised quail were released; however, the mechanics of cause and effect were obscure. Recent research on this topic (DeVos and Speake 1995) in Alabama did not indicate any large increases in wild quail mortality due to predation; however, their data did suggest that slight increases in mortality could be expected. A similar study in South Carolina (Mueller et al., unpublished data) has similarly seen no increased mortality of wild birds due to pen-raised bird releases after 1 year of study. These discrepancies are most likely due to differences in wild quail density, as well as the size and scope of the pen-raised quail release. Our wild-release study site had an abundant native quail population and was surrounded on 3 sides by thousands of hectares of excellent quail habitat and abundant wild quail populations. The neighboring property that liberated the pen-raised birds was literally an "island" in a sea of wild quail land. This led to an unusual set of circumstances where a large number of pen-raised birds were introduced into an area already populated by a large number of wild quail. Our observations were that many species of quail predators, especially hawks and owls, were drawn to this site to prey on liberated birds and this increased predation pressure carried over to the wild birds as well. Other sets of circumstances such as lower native quail populations and/or a more widespread release of pen-raised birds at a lower density may not produce the same predator-prey interactions we observed or the increased mortality we documented.

This study was the result of taking advantage of a "natural experiment" that was beyond our control and was therefore unreplicated in nature. This limits the inferences that can be drawn; however, the data suggest that large scale pen-raised bird releases on or near a wild bobwhite area can negatively effect wild bobwhite survival. The fact that these relationships were documented for 3 consecutive years supports this case. This could prove significant as our studies of managed quail land in the area are documenting the importance of overwinter survival in maintaining high bobwhite populations (Burger et al. 1998). In addition, little is known about other possible interactions between pen-raised and wild bobwhites such as those concerning diseases and genetics.

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