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EXPERIENCES IN NORTHERN BOBWHITE PROPAGATION AND TRANSLOCATION IN OHIO, 1978–2012

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ABSTRACT

Ohio once boasted a population of 7 million northern bobwhites (*Colinus virginianus*). Catastrophic blizzards during 1976–1977 and 1977–1978 brought winter quail mortalities of 85% and 80%, respectively. Ohio's bobwhite population was 430,000 in 1978, a 90% reduction from 1976. Remnant quail populations were small, isolated, and incapable of rapid recovery. The Ohio Department of Natural Resources (ODNR) initiated a statewide stocking effort to expedite population growth. The ODNR chose to propagate wild quail in captivity and release first-generation progeny (F1). Throughout 1980–1986, the ODNR released 65,000 F1 quail statewide. The ODNR monitored population response with North American Breeding Bird Survey, mail carriers, and roadside whistle-counts, but found little evidence of success. The ODNR evaluated postrelease survival and productivity of F1 hens ($n = 100$) and wild hens ($n = 40$) during 1984–1986 and deemed F1 hens inferior to wild hens. In 1993, the ODNR produced population models to develop minimum stocking rates for wild quail translocation, but insufficient numbers were captured. From 1998 to 2000 and 2005 to 2009, the ODNR translocated wild quail from Kansas to 5 Ohio sites with suitable, unoccupied habitat. Concurrently the ODNR translocated wild quail within Ohio. The ODNR conducted annual spring whistle-counts on all release sites during 1998–2012. Little or no evidence of sustained populations existed on sites after 7 years. Bobwhite translocation may yet show promise for population restoration, but evaluation should include 7–10 years of monitoring at a minimum.

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During 1960–1976, autumn populations of northern bobwhite (*Colinus virginianus;* hereafter, bobwhite) in Ohio averaged >4.5 million birds and occupied all 88 counties in the state. Annual fluctuations of up to 40% from this population mean were considered normal during this time (Urban 1978). Bobwhite populations in Ohio and other states along the northern extent of the range are subject to temporary, precipitous depressions as a result of periodic severe winter weather events (e.g., blizzards). For example, statewide bobwhite populations declined to a fraction of their previous level during the winters of 1935–1936 and 1944–1945. In the years following these events, more favorable weather prevailed and populations rebounded with little or no assistance from wildlife managers (Dambach 1948).

Ohio bobwhite populations reached unprecedented lows following catastrophic blizzards in the late 1970s (Sauer et al. 2014). The Ohio Department of Natural Resources (ODNR) recorded abnormally high bobwhite mortality (85% and 80%, respectively) during the winters of 1976–1977 and 1977–1978. Losses were thought to be most severe in the northern half of the state, where bobwhites were believed to have been extirpated within some counties. In addition, spring to autumn increases in 1977 and 1978 (58% and 166%, respectively) were well below the documented average (294%; Urban 1978). Urban (1978) attributed these unusually low reproduction rates to the poor body condition of bobwhites in the spring following extremely severe winters. In 1978 Ohio's autumn bobwhite population was estimated to be 430,000, >90% below the 17-year mean (Urban 1978). The ODNR closed the bobwhite hunting season statewide in 1978 and began to consider strategies to expedite population recovery.

Prior to 1976, the ODNR considered artificial propagation and translocation to be ineffective and unnecessary management actions for bobwhite. Any potential benefit derived from these activities was likely incidental to natural production (Dambach 1948). In addition, all available habitat within the state was thought to be occupied at the time, leaving little potential to expand the range or increase abundance of bobwhite in Ohio (Ohio Division of Wildlife 1955). By 1978, the ODNR believed large amounts of suitable habitat were unoccupied in the state, including several counties with extirpated bobwhite populations. The ODNR believed sufficient habitat existed in 1978 to support bobwhite populations at or near levels observed statewide in 1976, yet acknowledged the possibility that the state's remnant

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bobwhite population did not possess the capacity to return to preblizzard abundance and distribution without assistance (Urban 1978).

The ODNR made numerous efforts to reestablish bobwhites in the state through propagation and translocation during the past 3 decades. Unfortunately, populations remain at near-record lows, and the bobwhite range in the state appears to be contracting (Spinola and Gates 2008). Interest in captive propagation and wild translocation persists, particularly in areas outside the remnant bobwhite range in the state. Within this paper we have prepared a summary of the ODNR's bobwhite propagation and translocation projects since 1978, and we offer some interpretation of project results. This information should provide insight into some problems associated with bobwhite propagation and translocation efforts, and encourage investigation of unanswered questions.

METHODS

We conducted a comprehensive review of published and unpublished information on bobwhite propagation and translocation attempts conducted by the ODNR during 1978–2012. We amassed and summarized all relevant information including research reports, project updates, and miscellaneous interagency documents.

RESULTS

The ODNR's efforts to restore statewide quail populations in Ohio were continuous throughout 1978–2012, but methodology evolved as the ODNR identified and altered ineffective techniques. We distinguish between 2 distinct projects implemented by the ODNR, including 1) captive propagation of wild-caught bobwhite, and 2) translocation of wild-caught bobwhite.

Captive Propagation

During the winter of 1978, ODNR staff captured wild adult bobwhites using baited funnel traps and transported them to the state-owned Wildlife Propagation Unit in Urbana, Ohio. The ODNR captured 379 wild bobwhites during the winter of 1978 and supplemented this breeding population with an unknown number of wild birds captured in subsequent years (S. Norris, ODNR, personal communication). Wild-caught bobwhites were paired within indoor 5-row battery breeding cages and egg laying was artificially stimulated using lights. Eggs collected from breeding cages were placed in an incubator until hatching occurred. Newly hatched first-generation (F1) chicks were kept in heated brooder pens for 3–4 weeks before being allowed outside. At 10–14 weeks the F1 bobwhites were moved to 45.5-m-long outdoor, wire-floored, flight conditioning pens. Flight conditioning pens promoted acclimation to the elements and were large enough to allow birds to exercise legs and wings. Vegetation cover within the flight pens consisted of evergreen boughs and herbaceous weeds growing through the wire floor. Chicks were fed 28% protein poultry starter

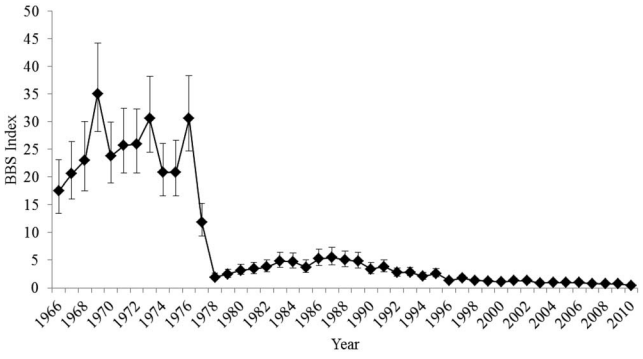

Fig. 1. Population trend of northern bobwhite in Ohio, USA, during 1966–2010 based on the North American Breeding Bird Survey (BBS) Index. The figure includes the BBS Index and 95% confidence interval (Sauer et al. 2014).

for 2 weeks, followed by 26% protein feed until 8 weeks, and then 20% protein poultry pellets until release. Most food and water was provisioned automatically, and human contact was minimized. Antibiotics were administered as normal practice (Henry and Shipley 1989).

The ODNR released F1 bobwhites throughout the state in areas perceived to have suitable habitat and scarce or nonexistent bobwhite populations. F1 bobwhites were released in groups of 20 with a 1 : 1 sex ratio. Releases occurred during late winter or early spring to minimize winter losses while allowing bobwhites time to acclimate to new surroundings before the onset of breeding activity (Urban 1978). Some autumn releases occurred when F1 production exceeded the capacity of holding pens. The ODNR released >65,000 F1 bobwhites in ≥83 Ohio counties throughout 1980–1986. The ODNR utilized the North American Breeding Bird Survey (BBS) and a Rural Mail Carrier (RMC) survey to monitor bobwhite population changes during the F1 program. Gradual increases in the BBS index occurred in the 1980s (Fig. 1) and in 1984 the ODNR reopened quail hunting season in select counties in southwestern Ohio. Yet, the ODNR did not observe anticipated improvements in quail numbers and distribution, which prompted questions about whether F1 bobwhites were contributing to wild recruitment.

In 1984 the ODNR initiated a 2-year study to quantify the contribution of F1 releases to the wild bobwhite population. Henry and Shipley (1989) compared the survival and reproduction of F1 ($n = 100$) and wild translocated ($n = 40$) bobwhite hens fitted with bib-mounted very high frequency transmitters. Within each cohort (F1 and wild) groups of 20 hens were released on 4 study sites over 2 consecutive autumn and spring periods during 1984–1986. Wild hens were released >50 miles (~80 km) from capture locations. Postrelease movement by F1 and wild hens did not differ (0.5 km and 1.6 km, respectively). Apparent survival of F1 hens to 10 weeks postrelease was comparable between autumn and spring release periods (12.8% and 8.5%, respectively). Survival of wild hens was higher following a spring release than an autumn release (36.9% and 17.3%, respectively). Henry and Shipley (1989) suggested this was evidence of a positive survival advantage associated with wild hen

maturity. F1 and autumn released wild hens experienced heavy mortality (>50%) during the first week postrelease, whereas spring released wild hens showed only 20% mortality over the same period. Within both cohorts, evidence of nesting was limited to hens released in the spring. Henry and Shipley (1989) found no difference between cohorts in the time between release and the start of incubation (44 days and 47 days for F1 and wild hens, respectively). The timing of nest initiation corresponded with established bobwhite nesting periods in Ohio, irrespective of cohort or release date. Of the F1 hens, a single individual was known to have hatched a clutch, although the hen was predated 1 week after hatch. Of the wild hens, 6 clutches were produced, 2 of which were observed with hens ≥4 weeks posthatch. Henry and Shipley (1989) suggested that multiple factors likely contributed to the poor survival and reproduction of F1 hens, including unfamiliarity with a new environment, inadequate conditioning to native foods and cover, and a lack of predator avoidance behavior. Henry and Shipley (1989) considered F1 hens to be considerably less wary than wild hens for a short time postrelease. F1 hens were often found in open areas outside of protective cover and were frequently approached by observers without fleeing. When flushed, F1 hens flew relatively short distances compared with wild bobwhites and often began vocalizing immediately after landing. These behaviors were not observed in wild bobwhites at any time postrelease and were no longer observed in F1 bobwhite beyond 3 weeks postrelease.

Henry and Shipley (1989) determined late spring translocation of wild adult bobwhite held the greatest potential for successful reestablishment within suitable unoccupied habitat. This release group demonstrated higher survival and productivity than other release groups, and was the principal source of recruitment during the study. Important questions remained, including the number of wild bobwhite necessary to establish a self-sustaining population within suitable unoccupied habitat.

Translocation of Wild-caught Bobwhite

Kansas translocation.—Henry (1993) used stochastic population modeling and survival and reproductive parameters determined by Henry and Shipley (1989) to estimate the minimum number of wild adult bobwhites necessary for successful reestablishment through translocation. Henry (1993) estimated that ≥80 bobwhites (40 M, 40 F) per release site were necessary to yield sufficient brood stock (~45 birds) 12 months postrelease. In 1995 the ODNR initiated a study in which wild-caught bobwhites were to be released in groups of 40, 80, and 120, with 3 replicates of each. The ODNR trapping efforts targeted bobwhite strongholds in southwestern Ohio, yet captured insufficient numbers of wild bobwhites to meet these goals. During 1995, 1996, and 1997, only 52, 34, and 84 bobwhites were caught, respectively. Despite falling well short of project goals, captured quail were released within predetermined sites in Knox and Morrow counties (Fig. 2). Roadside whistle-count data from these sites during 1995–1997 are incomplete, but there was no

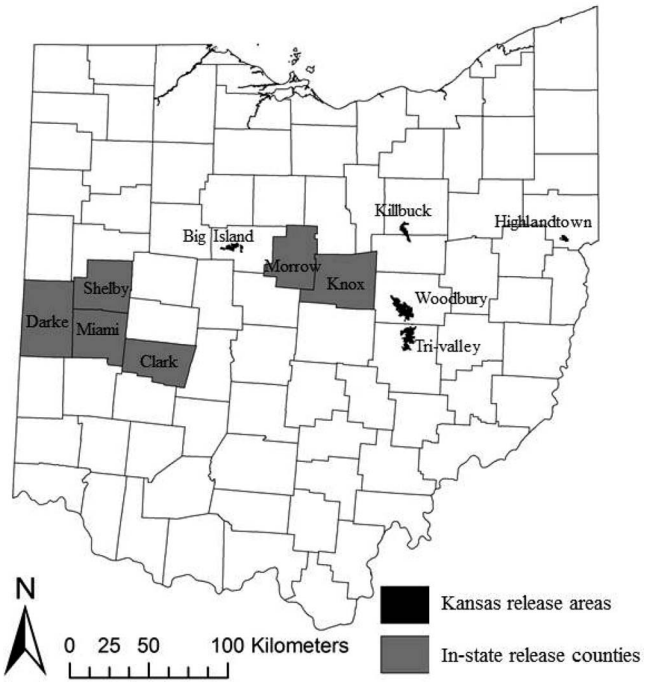

Fig. 2. Release locations for wild-caught northern bobwhite during in-state and out-of-state translocation efforts in Ohio, USA, during 1999–2010.

evidence of successful establishment. No bobwhites were detected via whistle counts on the Morrow County site in 1996, 1 year after release. In addition, ODNR biologists described an "absence of quail" (Traylor 1997) on release sites corresponding to declines documented in the 1996 RMC Survey. These regional population declines were attributed to the "difficult winter of 1995–1996" (Traylor 1997). Given the difficulties of trapping wild birds in Ohio, Traylor (1997) suggested that the ODNR investigate out-of-state sources of wild bobwhite.

In 1997, the Kansas Department of Wildlife and Parks (KDWP) agreed to provide the ODNR with wild bobwhite for translocation to large public lands in Ohio. The release locations had no evidence of bobwhite populations and little or no potential for natural colonization. Once established, bobwhites in these areas were intended to serve as source populations for future translocation efforts in Ohio. The first of 2 agreements permitted the ODNR to trap 250 quail annually during 1998–2000. The second agreement permitted the ODNR to trap 250 quail annually during 2005–2008. Although the 250 bobwhites/year would have permitted the ODNR to examine previously established release goals of 40, 80, and 120 birds, the 1995 investigation of stocking rates was apparently abandoned while Henry's (1993) recommendation of ≥80 birds/release was embraced.

Trapping efforts were focused on 2 areas in east-central Kansas. Bobwhites were captured using baited funnel traps and were held in Kansas for up to 4 weeks until a sufficient number (~100) were ready for transport to Ohio via aircraft. During the initial trapping period in 1998, 155 bobwhites were captured and transported to the 19,246-acre (~7,789-ha) Woodbury Wildlife Area

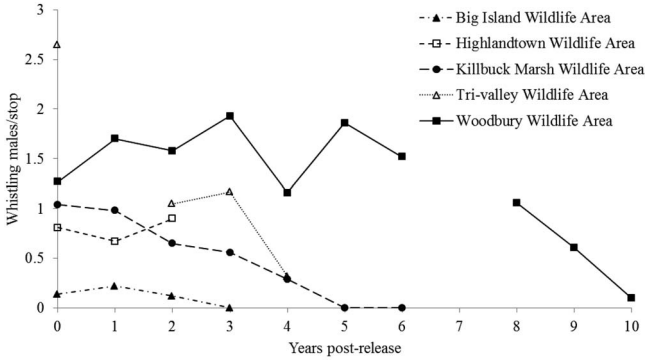

Fig. 3. Whistling male northern bobwhite heard per stop on 5 State Wildlife Areas in Ohio, USA, during the years following release of wild-caught northern bobwhite from Kansas, USA. Surveys were conducted during 1999–2012.

(Woodbury) in Coshocton County for release. During October–November 1999, 180 bobwhites were captured in Kansas and released at the 5,872-acre (2,376-ha) Big Island Wildlife Area (Big Island) in Marion County. During the final trapping period of the first agreement 163 Kansas quail were transported to the 5,671-acre (∼2,295-ha) Killbuck Marsh Wildlife Area (Killbuck) in Wayne County (Hull 2001). During late winter 2005, 167 quail were trapped in Kansas and transported to Ohio for release on the 15,181-acre (∼6,144-ha) Tri-Valley Wildlife Area (Tri-Valley) in Muskingum County. Bobwhites captured during 2006 were also released on Tri-Valley, while birds captured during 2007 were released on the 2,265-acre (∼917-ha) Highlandtown Wildlife Area (Highlandtown) in Columbiana County (Fig. 2). Inclement weather conditions in 2008 were believed to have adversely affected quail populations in Kansas, and the ODNR and KDWP agreed to suspend trapping temporarily. Trapping commenced in 2009 and all birds captured were released at Highlandtown (Stricker 2010).

Spring whistle call-counts and brood surveys were established within release areas to document overwinter survival and estimate productivity. Call-count routes ranged from 10 to 15 stops approximately 0.5 miles (∼0.8 km) apart. Routes were initiated on each site following the initial release and were run weekly during the month of June. Observers recorded the number of calling males at each stop for 5 minutes. During August, brood searches were conducted in areas determined to have potential breeding activity based on call-count surveys. Sampling effort and efficiency for the brood survey were not tracked or measured. Brood survey observations were viewed simply as evidence of reproduction with potential for conservative estimates of reproductive success (Hull 2001).

Whistle-count survey results varied somewhat across sites (Fig. 3). In the years following the release at Woodbury, survey results and incidental observations were encouraging. Call-counts recorded 12–25 males during the 4-week survey in 1999 and 24–30 males in 2000. In August 1999, ODNR staff observed approximately 130 individual bobwhites at Woodbury, representing an estimated 10–15 broods produced in the first breeding season postrelease. It was believed brood production was similar on the area in 2000 (Hull 2001). Despite relative stability from 1999 through 2005, whistle counts during 2007–2009 showed marked declines. Roadside surveys within Woodbury detected bobwhite at only 4 of 17 points in 2009 and surveys outside the area found no evidence of quail in the surrounding landscape, although anecdotal sightings of quail off site were reported by wildlife area management staff and local residents.

Whistle count numbers at Big Island were dismal from the onset, though evidence of successful reproduction existed (Hull 2003). Quail numbers apparently remained very low for 4 years postrelease and surveys were discontinued on the area in 2003 (Hull 2005). The ODNR received reports of bobwhite in the vicinity of Big Island in 2006, but believed numbers were insufficient to maintain a viable population (Stricker 2010).

Initial survey results at Killbuck were positive, although detections steadily declined for 5 years post-release. Surveys did document apparent dispersal from the core release area, which may have contributed to declines. Additionally, inclement winter weather in 2003 was thought to have reduced the population. No bobwhites were detected on surveys at Killbuck during 2006 or 2007, after which surveys were discontinued on the area (Stricker 2007).

The first year (2005) of whistle-count surveys at Tri-Valley produced the highest number of calls per point of any release site. Autumn covey counts detected $\geq$8 individual coveys (Stricker 2010). Surveys in subsequent years showed considerable declines following years of inclement winter weather. In 2009 the ODNR shifted field-dog-trial activities to Tri-Valley from Killdeer Plains Wildlife Area in Wyandot County. The ODNR had concern field-dog-trial activities might threaten the viability of the nascent bobwhite population on Tri-Valley and made efforts to translocate wild bobwhites from Tri-Valley to Woodbury. Although 5 individual coveys were located on Tri-Valley, only 17 bobwhites were captured before trapping efforts had to be terminated at the start of field trial activities.

Initial whistle-count results at Highlandtown were lower than all sites except Big Island, but counts remained fairly steady for 3 years. Additionally, detections suggested that bobwhites had dispersed throughout the area, including onto surrounding private land. Unfortunately, evidence of bobwhites at Highlandtown disappeared shortly after a severe winter weather event in northeastern Ohio and surveys on this area were discontinued.

In-state translocation.—In 2001, Hull (2001) cautioned that despite positive results in initial years, multiple years of monitoring would be required to determine whether sustained populations had been established through translocation. Yet, the ODNR initiated an in-state translocation effort in 2002 based largely on the perceived success at Woodbury (Hull 2003). The objective of this effort was to trap wild bobwhite in the core of the Ohio range and release them to nearby counties, which supported wild quail as recently as the

Table 1. Mean number of whistling northern bobwhite males heard per stop at release sites in years following initial release of wild-caught northern bobwhite from southern Ohio, USA, 2002–2012. '—' indicates route was not run.

Release site	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
SHEL1	0.70	1.30	2.41	3.26	2.25	0.86	2.17	2.73	1.80	0.00	0.00
DARK1		0.33	0.63	0.40	1.27	0.70	0.78	0.56	0.27	—	0.02
MIAM1			0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SHEL2				0.42	0.25	0.14	0.12	0.06	0.03	—	0.00
CLAR1					0.70	0.48	0.11	0.04	0.07	0.00	0.00
CLAR2						0.30	0.04	0.07	0.00	0.00	0.00
DARK2							1.00	0.13	0.00	—	0.00
SHEL3									0.00	0.00	0.00
MIAM2										0.00	0.03

early 1990s but no longer had evidence of bobwhite populations.

The ODNR captured bobwhites on public and private property in southwestern Ohio during winter using baited funnel traps. All bobwhites captured were kept at a holding facility at Spring Valley Wildlife Area in Greene County until an adequate number of birds were obtained for release (90–125). Bobwhites were released at a new release site each year. Supplemental feed was provided at the release site to keep the bobwhites localized for several days postrelease. Trapping occurred in Brown, Butler, Highland, and Preble counties and releases occurred on 8 sites determined to have suitable habitat in Clark, Darke, Miami, and Shelby counties. Suitable habitat was defined as 50% grassland and 10–20% brushland at the township scale (Frevert 2007). Within the selected townships, release sites were chosen by ODNR staff based on the quality and quantity of contiguous bobwhite habitat available, as well as the presence of linking corridors (i.e., riverine watersheds). Release sites were located on private property and were $>$3.7 miles ($\sim$6.0 km) apart (D. Malas, personal communication) All release sites were within counties closed to bobwhite hunting. During 2002–2011, 795 total bobwhites were relocated to 8 release sites.

The ODNR monitored in-state translocation release sites using midsummer call-count surveys and late-summer brood surveys similar to those used on Kansas translocation sites (Hull 2003). Several broods were detected by ODNR staff and private landowners 1 year postrelease in Shelby County, but it is unclear whether brood surveys were continued after 2002. The results of whistle count surveys in these areas were mixed and show very few bobwhite detections 5 years postrelease in most release sites. Only sites "Shelby Co. 1" and "Darke Co. 1" had strong evidence of population persistence beyond 5 years. In 2011, no bobwhites were detected during any surveys, though 3 routes were not run (Table 1). During 2012, 2 whistling bobwhites were detected on all routes combined and whistle counts were discontinued shortly thereafter.

DISCUSSION

In the late 1970s, the ODNR conceded that artificial propagation and translocation could be justified where wild stock was severely depleted by temporary causative factors (e.g., weather) leaving suitable bobwhite habitat unoccupied with little potential for natural recolonization (ODNR 1984). The ODNR cited $\geq$2 studies that showed abnormally low population levels caused by irregular occurrences could be improved through the release of hatchery stock (Brill 1941, Duck and Fletcher 1944). The ODNR deemed the release of commercial hatchery stock inappropriate because the circumstances and conditions under which birds are bred and reared likely eliminated many of the physical and behavioral qualities necessary for survival in the wild. The ODNR believed the introduction of hatchery stock could seriously damage the existing gene pool given the extremely low number of remnant wild birds in the state (Urban 1978). The ODNR considered translocation of wild-caught bobwhite preferable, but this method was not feasible given the quantity of bobwhites needed far exceeded the number that could be caught. Wild translocation at a statewide scale was thought to be an economic and logistic impracticality for the agency (Henry and Shipley 1989). Captive propagation of wild-caught bobwhites and the subsequent release of F1 progeny were feasible solutions to these issues (Urban 1978). F1 bobwhites were produced in relatively large quantities, and met the established release goal of 10,000 birds released/year statewide. Additionally, F1 bobwhites maintained near-wild genetic expression. In theory, F1 bobwhites possessed the most innately determined behavioral attributes achievable in a captive-reared bobwhite (Henry and Shipley 1989).

Backs (1982) found that F1 bobwhites survived for a significantly longer period than did commercial hatchery stock following spring or autumn release into suitable unoccupied habitat, but questions remained about the survival and reproduction of F1 bobwhites relative to translocated wild bobwhites. Henry and Shipley (1989) concluded that F1 bobwhite propagation with regard to genetic wild programming coupled with minimized human contact in rearing was not an effective population restoration strategy. The contribution of innately determined behavioral attributes to overall survival and reproduction in the wild is important, but attributes derived from extrinsic factors are likely to play a large role in determining survival and reproductive potential of released bobwhite (Roseberry et al. 1987, Henry and Shipley 1989). Henry and Shipley (1989) noted that the potential impact of enhanced prerelease conditioning

procedures on F1 survival was unknown and merited further investigation.

F1 bobwhites reared and released in Ohio during 1980–1985 likely survived and reproduced at very low levels in many areas of the state. Henry (1993) speculated that failure to reestablish bobwhite populations was the result of an insufficient density of bobwhite in release areas to increase natality to the point of population growth and expansion. He questioned whether 20-bird releases were adequate in light of known rates of loss (e.g., mortality, dispersal). In 1993, Henry completed a thorough literature review on bobwhite translocation and consulted with biologists involved with translocation efforts within multiple states. Across the species' range, methods varied and opinions differed about the value of bobwhite translocation.

The ODNR's efforts throughout the past several decades show no evidence that translocated populations persist. It is probable Ohio's various bobwhite translocation efforts during 1978–2012 produced small isolated populations that were extremely vulnerable to stochastic extinction in the years immediately following initial release. Throughout this period numerous observations suggested that inclement winter weather was detrimental to nascent populations. Even within areas perceived to contain large amounts of suitable habitat, the impact of stochastic events may have been exacerbated by the isolation of the populations. The ODNR has achieved success in reintroduction of other species (e.g., wild turkey [*Meleagris gallopavo*]), but has no evidence that propagation and translocation efforts in recent decades had any measurable effect on statewide bobwhite abundance or distribution. Recent population indices reflect continued declines and range contraction, even within population strongholds in southwestern Ohio.

Translocation of wild-caught bobwhite appears to offer the greatest potential for successful population establishment through artificial means. It is yet unclear whether Henry's (1993) recommendation of 80 bobwhites is sufficient and bears continued investigation where feasible. It may be necessary to consider repeated releases on the same site in consecutive years to bolster newly established populations, increase density, and increase natality to the point of population growth. Dispersal from newly released populations was noted on several sites either through formal surveys or anecdotally. Dispersal from established bobwhite populations has been studied in the past, but it is unclear the degree to which dispersal was included in Henry's (1993) efforts to model quail population viability and stocking rates. We suspect that such movement of individuals away from novel, isolated populations should not be dismissed without consideration of the implications for population establishment and viability, especially where dispersal into hostile landscapes is likely.

MANAGEMENT IMPLICATIONS

Some tentative conclusions that can be drawn from Ohio's efforts to propagate and translocate wild bobwhites include 1) translocation of wild-caught bobwhites likely offers the greatest potential for successful population establishment in areas devoid of bobwhite; 2) along with high mortality and reduced reproductive rates, emigration may be a factor contributing to failure of translocated bobwhite populations isolated from existing populations; 3) population monitoring should occur in and around release sites for a minimum of 7–10 years and wildlife managers should remain circumspect in their assessment of success; 4) minimum stocking rates and annual stocking supplements need continued consideration.

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