Reproduction, Dispersal, and Survivorship of Ruffed Grouse Reintroduced into Arkansas

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Abstract: Reproductive success of 94 ruffed grouse (*Bonasa umbellus*) reintroduced into northern Arkansas during September and October 1984 was apparently low. Four broods were found during 2 reproductive seasons after release. Dispersal of all located male ruffed grouse was limited to a 1.6 km radius of the initial release site. Brood sightings in an area 2.4 to 2.8 km northeast of the initial release site were direct evidence of female dispersal. Survivorship of male grouse up to the first courtship drumming period was at least 25%.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 42:349–357

Ruffed grouse were once present in northern Arkansas, although there are few records of past distribution and abundance (James and Neal 1986, Smith and Petit 1987). The species was probably extirpated in Arkansas before 1900 (James and Neal 1986), although limited populations were known to exist in adjacent southern Missouri into the early part of this century (Bennitt and Nagel 1937).

Since the mid-1900s, several mid-western states have had varying success reintroducing wild-trapped ruffed grouse to areas within their original range (Gullion 1984). Successful reintroduction of ruffed grouse in Missouri (Lewis et al. 1968) and improved forest conditions in the Ozarks (Smith and Petit 1987) prompted the Arkansas Game and Fish Commission (AGFC), with initial assistance from the Na-

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Table 1. Number of ruffed grouse reintroduced into Arkansas 1981–1987, by release site, origin, age and sex.

Year	Release site	Trapping site	Adult male	Juvenile male	Adult female	Juvenile female	Total
1981	Ponca	Ky.	16	9	6	19	50
1982	Ponca	Va.	16	3	11	8	38
1982–83	Murray Creek	Minn.	16	13	3	12	44
1983–84	Murray Creek	Ohio	18	14	6	16	54
1984	Murray Creek	N.J.	2		1	1	4
1984	Sylamore	N.J.	38	7	8	15	68
1984	Sylamore	Ohio	12	3	4	7	26
1985	Madison County	N.J.	10	8	5	11	34
1985	Madison County	Wis.	33	16	24	10	83
1985–86	Fane Creek	N.J.	8	5	3	2	18
1986	Fane Creek	Pa.	6	21	4	17	48
1986	Fane Creek	Wis.	10	16	6	17	49
1986	Murray Creek	Wis.	3	4	5	4	16
1986	Murray Creek	Pa.	2	9	2	8	21
1986	Sylamore	Wis.	14	5	5	10	34
1986	Sylamore	Pa.	4		1	3	8
1987	Sulphur Creek	Wis.	32	20	17	22	91
1987	Sulphur Creek	N.J.	2	1	1		4
1987	Sulphur Creek	Pa.	15	24	12	5	56
Total			257	178	124	187	746

tional Park Service, to reintroduce wild-trapped grouse in Arkansas beginning in 1981. An earlier restocking attempt in which pen-reared birds were released in 1948–1950 failed after a few years (James and Neal 1986).

Approximately 750 ruffed grouse trapped in other states have been released at 6 sites in the Arkansas Ozarks since 1981 (Table 1; Ark. Game and Fish Comm., unpubl. rep., 1988). All releases have been made on public lands (Fig. 1). Releases have been monitored primarily by conducting drumming counts in spring, occasional snow-track censuses in winter, and by auxillary sighting records by AGFC personnel and others. Limited observations of grouse from blinds and by mirror trapping have documented the presence of at least 2 unbanded birds, presumably progeny of banded, released birds, at the Ponca and Murray Creek release sites (Pharris et al. 1983). Two nesting attempts (1 successful) and 4 brood sightings were documented during summer 1987 in the vicinity of the Ponca, Madison County, Murray Creek, and Sylamore releases (R. Smith, pers. commun.), showing that reintroduced grouse reproduced.

Our study was conducted to determine reproductive success, dispersal, and survivorship of 94 ruffed grouse released during September and early October 1984 near Fifty-six in the Sylamore District of Ozark National Forest, Stone County, Arkansas. Sixty of those grouse were male, 34 were female (Table 1). A supplemental release of 42 grouse was made during fall 1986, but we have very little information on those birds. No grouse were known to be present on the study area prior to the 1984 reintroduction.

Start-up financial support for this research was provided by the Arkansas Audubon Society Trust. Major funding was provided by the Arkansas Game and Fish Commission Federal Aid Project W-56:II-D-1 in cooperation with the U.S. Fish and Wildlife Service and the Ozark National Forest. The authors thank Mike Pledger, Ron Smith, and Bruce Cook for assistance with various aspects of this research.

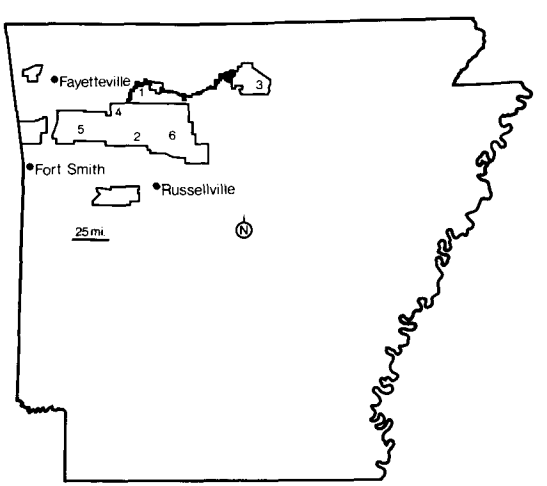

Figure 1. Vicinity map of the 6 segments of Ozark National Forest (outlined areas), the Buffalo National River (darkened area) and ruffed grouse reintroduction sites in Arkansas. 1 = grouse release near Ponca, Buffalo National River, Newton County. 2 = release near Murray Creek, Ozark National Forest, Johnson County. 3 = release near Fifty-six, Sylamore District, ONF, Stone County. 4 = release near Red Star, ONF, Madison County. 5 = release near Fane Creek, ONF, Franklin County. 6 = release near Sulphur Creek, ONF, Pope County.

Methods

Field research extended from 1 May 1985 to 31 December 1986. This research was conducted primarily on a circular study area, 2.4 km in radius, in the Sylamore District of Ozark National Forest, the site on which all 94 ruffed grouse were released in 1984 (Fig. 2). Most of the Sylamore District is managed jointly by the U.S. Forest Service and the AGFC as a cooperative wildlife management area.

The area is part of the Springfield Plateau sub-division of the Ozark Plateaus (Foti 1974). Soils are mainly limestone-based silts and loams of poor fertility, best suited for forest and pasture production (Ward 1983). Terrain is deeply cut by many

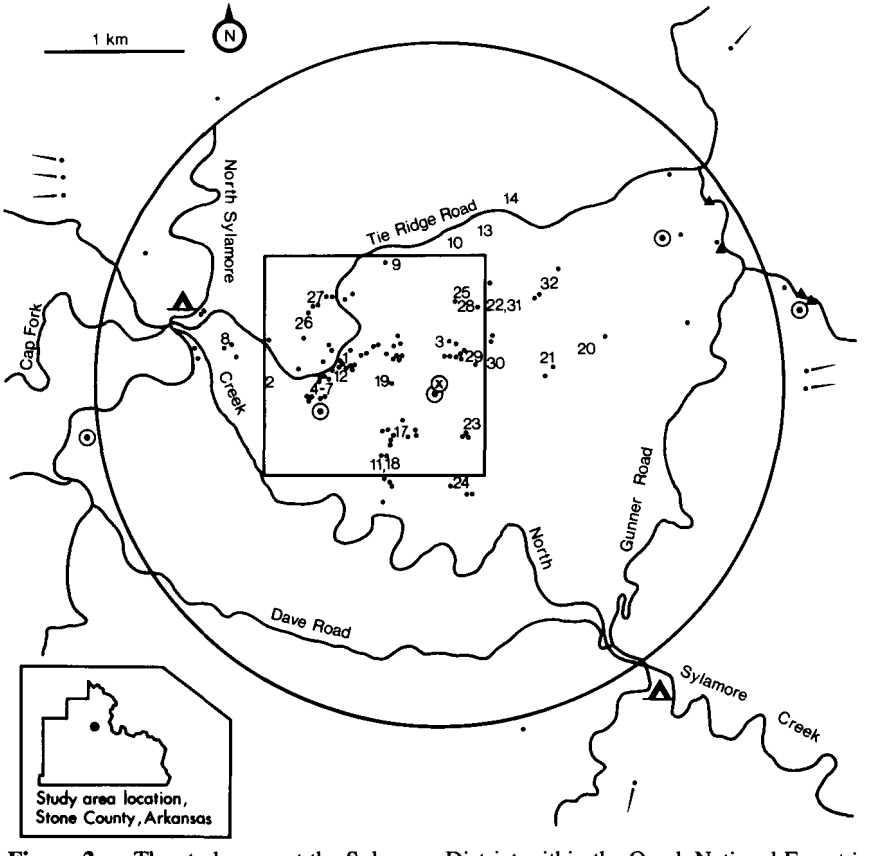

Figure 2. The study area at the Sylamore District within the Ozark National Forest in Stone County, Arkansas (see insert). Circle indicates study area (2.4 km radius). The 1.6-km square was the drumming count area surveyed by the AGFC. Drumming logs are indicated by number, sequentially based on verification as same. ⊗ = 1984 release site, ⊙ = 1986 release sites, • = grouse locations, ▲ = brood locations and •—— = grouse locations off map with directional arrow.

small, mostly intermittent streams, and by North Sylamore Creek. Floodplains and ridge tops are narrow and intervening slopes of 10 to 40 degrees are common. Elevations range from 135 to 350 m above sea level.

Upland hardwoods, mainly white oak (*Quercus alba*), black oak (*Quercus velutina*), and hickories (*Carya* spp.), constitute the most common forest type on the study area (Widner 1987). Smaller percentages of the area are in shortleaf pine (*Pinus echinata*) stands, pine-hardwoods, cedar (*Juniperus* spp.) glades, and bottomland hardwoods, mainly sweetgum (*Liquidambar styraciflua*), American sycamore (*Platanus occidentalis*), and various oaks. Approximately 15% of the study area is an even-aged, early successional forest stage, because of clearcutting. This percentage is higher than the overall Sylamore District average because of downed timber cuts carried out after extensive tornado damage in 1975. The high percentage of early successional stages present was a major factor in selecting this area for ruffed grouse reintroduction. Two private tracts totaling approximately 250 ha were located on the south and east periphery of the study area. Those tracts were primarily mature hardwood stands, but also contained some old field succession and developed pasture.

Reproduction

Nest searches were conducted during late April and May 1985 and 1986. Areas adjacent to "openings" or old roads, near drumming logs, and with pole timber stands received preferential treatment because of their use by nesting grouse (Bump et al. 1947). During late May, June, and July, ruffed grouse chick distress or lost calls were played on a portable tape recorder using high frequency speakers to attract females with broods (Healy et al. 1980). Areas with early successional stages and mesic north slope and stream bottom situations primarily were chosen for those non-systematic searches. Also, 11 north-south transects, at 0.4-km intervals, were established on the study area and walked to discover broods, particularly during summer 1986. Non-systematic searches for broods also were conducted in early successional forest types, north slope, and mesic locations.

Lily-pad traps (Liscinsky and Bailey 1955) were used in September 1985 and 1986 to capture broods prior to fall dispersal. Limited efforts were made during spring 1986 to view drumming male grouse from a blind or trap them with mirror traps (Tanner and Bowers 1948) to determine if they were banded. Unbanded birds would be evidence of reproduction, since all released birds were fitted with numbered, aluminum leg bands.

Dispersal

Locating drumming sites or activity centers (the area in the immediate vicinity of drumming logs, Gullion et al. 1962) provided information on dispersal by male ruffed grouse. Those surveys were conducted by AGFC personnel during spring 1985 and in 1986 in a 1.6-km^2 area overlying the initial release site and were verified by the senior author. Extensive searches for drumming sites outside this area provided additional information on dispersal by male birds. All other ruffed grouse

encounters made during the study and reliable sightings made by others off the study area furnished additional information on dispersal of released grouse or their offspring.

Survivorship

Survivorship of male ruffed grouse was estimated by comparing the number of drumming males heard the spring after release (1985) to the number originally released. Drumming logs also were checked monthly throughout the study for evidence of occupancy. Repeated contact with grouse in close proximity to a drumming log suggested individual survivorship, although replacements were certainly possible.

Results

Reproduction

A large part of 861 field hours was spent in efforts to document reproduction. Bases of approximately 14,000 trees or other objects within the study area were examined during May 1985, and an undetermined number were examined during April-May 1986, but no nests were found.

Chick distress or lost calls played at 148 locations both on and off the study area during both reproductive seasons produced 8 responses (4 each season) but no broods were found. Three birds were viewed sufficiently to be reasonably sure of sex, based on feather characteristics such as completeness of sub-terminal rectrix band. Two birds were believed to be males and 1 was believed to be female. One of the male respondents had just completed a drumming sequence prior to response to the call. One grouse, believed to be female (July 1985), was very vocal and defensive as she approached the call, suggesting a nearby brood, but none was found. Seven of the 8 responses were relatively close to known male activity centers.

Almost 90 km were walked along transects during summer reproductive periods (May through August) and a substantially greater area was covered in non-systematic searches of likely brood habitat. Although 35 individual adult ruffed grouse were flushed during the period when broods should have been present, no broods were located during these searches.

A total of 89 lily-pad trap-days during both Septembers of study produced no broods. Efforts to mirror trap or view 3 male grouse from a blind during spring 1986 proved futile. Those birds either failed to appear or drummed at other nearby logs.

Evidence of reproduction by released ruffed grouse was provided by observations of grouse along roads, however. During late May 1985, a female with a brood of approximately 10 very young birds was observed by a Forest Service employee approximately 2.4 km northeast of the initial release site (Fig. 2). During late June 1986, we observed a banded female bird and at least 3 young grouse approximately 0.3 km south of the 1985 brood location. Two other broods were observed about 0.8 km southeast of the above locations during early and mid-July 1986. Number of

young in the brood observed during early July was unknown, but there definitely were 2 young observed in mid-July. Those 2 young and the banded female responded repeatedly to a chick distress call after being flushed from the road. Exact numbers of broods represented by the 1986 observations is unknown, but we think there were at least 2 broods.

Dispersal

Springtime drumming counts, flushes and other grouse locations, broods observed, and reliable reports by others all contributed to knowledge of population dispersal by stocked grouse or their progeny. The majority of those locations were within 1.6 km of the original release site (Fig. 2). Evidence from spring and fall drumming, limited numbers of observations, molted feather characteristics such as rectrix length (Davis 1969) or number of tail covert spots (Roussel and Ouellet 1975) and inferences based on flushes in close proximity to drumming logs indicated that most of those birds were males. Approximately 15–16 males drummed in the AGFC drumming survey area (1.6 km^2) during spring 1985. Approximately 12–13 males drummed in that same area during spring 1986. Four other drumming males were located just east of that area during spring 1986. Very few female grouse appeared to be present within 1.6 km of the initial release site.

Other observations indicative of dispersal were made approximately 2.4 to 2.8 km northeast of the release site. These grouse locations were primarily female birds with young. No drumming males were heard in that area during spring 1986. Females in both established and reintroduced populations are known to be more mobile than males (Chambers and Sharp 1958, Woolf et al. 1984), and juvenile female dispersal is normally much greater than that of males (Chambers and Sharp 1958).

Eight reliable widely-scattered ruffed grouse sightings were made at distances from 3.2 to 16 km from the initial release site. Sex of those birds was unknown, except for 1 unverified report of a drumming male about 16 km from the release site received from a turkey hunter during spring 1986.

Survivorship

No data were collected on individual survivorship of ruffed grouse during the present study. However, the number of male birds that overwintered and were heard drumming the first spring after release was at least 25% of the number released. This survival rate is comparable to that reported for releases that eventually were successful in Missouri (Lewis et al. 1968). Continued checks of identified activity centers showed that approximately the same number of these centers were occupied at the end of the study as at the beginning. Some grouse probably died or moved during the study, but most activity centers remained occupied.

Direct evidence of female survivorship was limited to those birds seen with broods and to 1 bird believed to be a female that responded to a chick distress call during summer 1985. Based on direct evidence, survivorship of female grouse on or near the study area may have been less than that of male grouse.

Discussion

Reproduction by the released ruffed grouse was apparently low. This level of observed reproduction appears comparable to that observed in other mid-western states where ruffed grouse reintroductions have persisted for several years before eventual failure (Woolf et al. 1984), or where reintroductions have succeeded in establishing spreading populations at low densities (Lewis et al. 1968). A primary reason for low reproductive success appeared to be low numbers of surviving females. Supplemental releases of ruffed grouse during fall 1986 may increase the level of reproduction.

Male ruffed grouse dispersed rather evenly to activity centers located within 1.6 km of the initial release site. Most females that were located had dispersed farther than males. Whether released females were subject to the same stimuli as birds in established populations is unclear, but female mobility and juvenile female dispersal was greater than that of males in certain established northern populations (Chambers and Sharp 1958). If a majority of the 8 widely dispersed ruffed grouse sightings at Sylamore were female birds, they may have removed themselves from a breeding population by being too distant from the more sedentary male birds. Radio telemetry of both adult and juvenile female ruffed grouse after release might provide important information on survival and the effect that dispersal has on success of reintroductions.

Observed reproductive success and dispersal patterns suggest several reintroduction strategies: 1) release of more female ruffed grouse at an individual site with possible supplemental releases in future years, 2) release of male birds at more than 1 site in an effort to more evenly match the wider dispersal of female grouse, and 3) scattering several reintroductions throughout a moderately sized area (e.g., the Sylamore District) in an effort to limit isolation of individual birds and maximize breeding success.

Survivorship of male grouse appeared to be relatively good. Survival of female birds may not have been as good as that of males. Good survivorship of male birds has been noted for several Illinois reintroductions that eventually failed due to apparent lack of reproductive success (Woolf et al. 1984). Thus, criteria for evaluating success of Arkansas ruffed grouse reintroductions should include documentation of greater levels of reproductive success than that observed at Sylamore.

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