Reproductive asynchrony within social groups of female eastern wild turkeys

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Abstract

Eastern wild turkeys (Meleagris gallopavo silvestris) exhibit social hierarchies wherein dominance is established through agnostic interactions within social groups. When dominant individuals effectively monopolize reproductive opportunities, asynchronous breeding can occur, which may disproportionately influence individual fitness within social groups. For females, higher ranked individuals may witness reproductive advantages associated with earlier nesting than subordinate conspecifics. We evaluated reproductive synchrony within and between presumed social groups of GPS-tagged female eastern wild turkeys by inferring female social rank based on timing of nest initiation. We examined 30 social groups with an average of 7 females per group (range 2 - 15) during 2014-2019 in west-central Louisiana. We found that the estimated number of days between first nest initiation across females within social groups varied between 3-7 days across years, and the number of days between nest attempts was lower for successful than failed attempts. Our findings suggest that social hierarchies may influence reproductive success in female wild turkeys, and we postulate that social constraints could cause variation in timing of nest initiation for females within social groups.

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Abstract: Eastern wild turkeys (*Meleagris gallopavo silvestris*) exhibit social hierarchies wherein dominance is established through agnostic interactions within social groups. When dominant individuals effectively monopolize reproductive opportunities, asynchronous breeding can occur, which may disproportionately influence individual fitness within social groups. For females, higher ranked individuals may witness reproductive advantages associated with earlier nesting than subordinate conspecifics. We evaluated reproductive synchrony within and between presumed social groups of GPS-tagged female eastern wild turkeys by inferring female social rank based on timing of nest initiation. We examined 30 social groups with an average of 7 females per group (range 2 - 15) during 2014-2019 in west-central Louisiana. We found that the estimated number of days between first nest initiation across females within social groups varied between 3-7 days across years, and the number of days between nest attempts was lower for successful than failed attempts. Our findings suggest that social hierarchies may influence reproductive success in female wild turkeys, and we postulate that social constraints could cause variation in timing of nest initiation for females within social groups.

Key words: asynchronous, breeding, dominance, *Meleagris gallopavo* , nesting, social hierarchies, wild turkey

Introduction

Social information plays an important role in the distribution of wildlife across the landscape. Wildlife derive information on resource availability from the occurrence of individuals (Danchin et al. 2004), and the performance of conspecifics and heterospecifics, wherein habitat patches conferring improved fitness attract more individuals (Doligez et al. 2002, Campomizzi et al. 2008). Congregation of individuals within resource patches is often driven by conspecific attraction (Stamps 1988). As such, clustering of species during the reproductive period has shown positive fitness benefits via information transfer on resource availability, predation risk, and mate availability (Alexander 1974, Forbes and Kaiser 1994, Danchin et al. 1998, Strong et al. 2018). Thus, social information is a known determinant of reproductive decisions and underlies the coordination of the timing of reproduction (Brandl et al. 2019).

Coordination in timing of reproduction is driven by resource availability for a wide array of species (Lack 1968, Perrins 1970) as optimization of reproductive success hinges on matching reproductive activities with environmental conditions (Ims 1990). As such, temporal clustering of reproductively-active individuals is typically driven by climatic seasonality (Ims 1990), especially when breeding seasons are restricted to shorter temporal periods (Emlen and Demong 1975, Findlay and Cooke 1982). The availability of social information, which underlies spatial clustering, can influence temporal clustering (Helm et al. 2006) and certain life history events (migration, reproduction) are inherently clustered temporally (Lack 1968, Gochfeld 1980). Monogamous species regularly demonstrate a high degree of reproductive synchrony (Emlen and Oring 1977, Gochfeld 1980) as male investment in courtship limits extra-pair reproductive activities (Grant and Kramer 1992) with the consequence being synchronized reproductive activities (Knowlton 1979). Colonial birds consistently demonstrate high degrees of clustered nesting, (Darling 1938, Lack 1968, Gochfeld 1980), as individuals synchronize reproduction to simultaneously reproduce (Gochfeld 1980), resulting in higher rates of nest success (Di Maggio et al. 2013) by reducing offspring mortality (Darling 1938). However, in non-monogamous systems, social rank may dictate breeding access of individuals within a local population (Robel and Ballard 1974, Foster 1981). Typically, higher ranked males copulate with more females (Robel 1970, Buchholz 1997, Krakauer 2008), creating a pronounced reproductive skew (Emlen 1976, Mackenzie et al. 1995). When high-ranking males can more effectively monopolize access to females, asynchronous breeding is predicted to occur (Post 1992, Webster 1994). Thus, asynchronous breeding may disproportionately affect fitness amongst individuals, potentially increasing fitness of higher ranking individuals and decreasing fitness of lower ranking individuals.

The eastern wild turkey (*Meleagris gallopavo silvestris* ; hereafter, wild turkey) has a complex social structure, wherein flocks exhibit social hierarchies where the highest ranking individual dominates others and the lowest ranking individual dominates none (Watts and Stokes 1971, Eaton 1992, Healy 1992). The establishment of dominance hierarchies occurs through agonistic interactions within social groups and rank seldom changes as long as the dominant bird survives (Watts and Stokes 1971, Healy 1992). Male and female wild turkeys maintain separate social hierarchies within and between flocks and dominance is influenced by age

(Watts and Stokes 1971) and various morphological and behavioral attributes (Buchholz 1995, 1997, Badyaev et al. 1998). Wild turkeys use a male dominance polygynous mating system comparable to exploded lekking, wherein males communicate with females via elaborate courtship displays and vocalizations (Krakauer 2005, Chamberlain et al. 2018, Wakefield et al. 2020). The establishment of dominance hierarchies determines access to mates for both sexes (Emlen and Oring 1977, Williams and Austin 1988). In species that maintain social hierarchies, higher-ranking females may prevent subordinate females from gaining access to dominant males (Bro-Jørgensen 2002), and in some birds, higher ranking females may realize fitness advantages associated with early nesting (Robel 1970, Robel and Ballard 1974). In fact, social status can influence the onset of laying activity and lower ranked females may delay nesting attempts, causing asynchronous reproduction within social groups of females during a single breeding season (Cristol 1995).

We evaluated reproductive synchrony within and between presumed social groups of GPS-tagged female Eastern wild turkeys by inferring female social rank based on timing of nest initiation (Watts and Stokes 1971, Schmutz and Braun 1989, Healy 1992, Cristol 1995). We hypothesized that the social rank of dominant females, inferred from the onset of nest initiation, would influence the timing of reproduction in subordinate females. We predicted that dominant females would nest first, and when their initial nest failed, would rejoin their previous social group and reinsert themselves in the reproductive hierarchy over remaining subordinate females presumably attempting to mate. Therefore, we predicted that dominant females who nested first would be more likely to have subsequent renest attempts before subordinate females attempted their first nest. We also predicted that dominant females would travel shorter distances within their reproductive ranges prior to onset of nest initiation.

Study area

We conducted research on the Kisatchie National Forest (KNF) and Peason Ridge Wildlife Management Area (WMA) in west central Louisiana. The KNF was owned and managed by the United States Forest Service (USFS) and divided into 5 Ranger Districts. We conducted research on the Catahoula Ranger District, Kisatchie Ranger District, Winn Ranger District, and the Vernon unit of the Calcasieu Ranger District located in Grant, Natchitoches, Winn, and Vernon parishes, respectively. Peason Ridge WMA was jointly owned by the USFS and the U.S. Army. The spatial area of Catahoula Ranger District, Kisatchie Ranger District, Winn Ranger District, Vernon unit, and Peason Ridge was approximately 49,169 ha, 41,453 ha, 67,408 ha, 61,202 ha, and 74,309 ha, respectively. Our study sites were composed of pine-dominated forests encompassing rolling hills, high ridges, and sandy creek bottoms. Vegetative communities consisted of loblolly pine (*Pinus taeda*), longleaf pine (*P. palustris*), short leaf pine (*P. echinata*), slash pine (*P. elliotti*), mixed pine hardwood forests, and hardwood riparian areas. Our sites contained forest openings, utility rights-of-way, and forest roads distributed throughout. Rural infrastructure, agricultural fields, pasture, and privately-owned lands used for industrial timber bordered our study sites. Prescribed fire was applied on a 3–5 year return interval. The study sites experienced subtropical climates with mean daily temperatures ranging from a low of 9.4°C in January to a high of 28.3° C in July, and mean rainfall averaged ~ 114 cm.

Methods

We captured female wild turkeys using rocket nets baited with corn from January – March 2014–2019. We aged each individual using the presence of barring on the 9th and 10thprimaries (Pelham and Dickson 1992). We fitted all females with a uniquely identifiable aluminum rivet tarsal band and backpack style GPS/VHF transmitter (Biotrack Limited, Wareham, Dorset, UK; Guthrie et al. 2011). We programmed GPS units to collect data at 1-hour intervals (Cohen et al. 2018) between 05:00 to 20:00 daily with one location at night (23:59:58) to identify roosts until the battery died or the unit was recovered. We immediately released individuals at the capture location following processing. Capture, handling, and marking procedures were approved by the Louisiana State University Agricultural Center Animal Care and Use Committee (Permits A2015-07 and A2018-13). We monitored live-dead status daily during the reproductive season using handheld Yagi antennas and Biotracker receivers (Biotrack Ltd., Wareham, Dorset, UK). We downloaded GPS locations once per week via a VHF/UHF handheld command unit receiver (Biotrack Ltd., Wareham, Dorset, UK).

When winter flocks disband, social groups of wild turkeys alter space use and focus efforts on reproduction (Badyaev et al. 1996*b* , Thogmartin 2001). We assumed that all females within a social group had access to the same mates, and presumably the same dominant males. Therefore, we defined a social group as a group of females captured together during January to March as GPS data indicated that turkeys did not disperse from wintering flocks before reproduction started, contrary to suggestions in Badyaev et al. (1996*a*). While we defined females captured together as a social group, we acknowledge that we may not have captured all of the females in the same breeding group. We assumed, based on estimates of daily movements by females (Conley et al. 2016, Bakner et al. 2019), that individuals captured within 2 km of each other were members of the same social group as these individuals regularly interacted as detailed herein. To further ensure we accurately defined social groups, we used a dynamic Brownian Bridge movement model (dBBMM) to create 99% utilization distributions (UDs) for each individual (Byrne et al. 2014) for the 21 days before the first female in each group laid the first egg at an eventual nest site. We chose a 21-day period because we were interested in overlap in space use during the time immediately preceding initiation of the first nest in the social group, under the assumption that this individual was the dominant female in the group (Watts and Stokes 1971). We calculated all UDs in program R version 3.2.5 (R Core Development Team 2020) using package move (Kranstauber and Smolla 2013). We used a window and margin size equal to 21 and 9 respectively, and a location error of 10 m (Byrne et al. 2014). Individuals that share space may constitute a single social unit (Brown 1975), therefore we calculated the percentage of utilization distributions that overlapped at least one other UD within a defined social group during the 21-day period to quantify shared space use (Kernohan et al. 2001). We assumed that any females who did not maintain an overlapping range with at least one other female within a social group or individuals within subgroups were of lower rank, and as such should subsequently nest later (Ringgenberg et al. 2015). We defined smaller groups that contained 2-3 individuals with ranges that overlapped each other, but did not overlap with the main social group, as a subgroup (Figure 2).

We determined locations of each nesting attempt for each female when an individual's locations became concentrated around a single point for several days (Guthrie et al. 2011, Conley et al. 2015, Yeldell et al. 2017, Wood et al. 2019). We defined the first date of nest incubation as the first day we recorded the nightly roost location at the nest site, indicating the female continued incubation during the night (Bakner et al. 2019). To determine the first date of egg laying (hereafter nest initiation), we evaluated GPS locations to determine when a female initially visited the nest site as female wild turkeys do not visit their nest site until they lay their first egg (Conley et al. 2016, Collier et al. 2019). We monitored each nesting attempt following Bakner et al. (2019) and after nest termination, located nest sites using VHF telemetry and GPS data to confirm the nest location and determine nest fate. We considered a nest to have been depredated or abandoned if the female left the nest [?]25 days into incubation, or if only intact eggs, no eggs, or egg fragments were found at the nest bowl. We considered a nest successful if [?]1 live poult hatched, and was confirmed visually during subsequent brood surveys following methods outlined in Chamberlain et al. (2020).

We scaled the initiation date of the first nest attempt to each social group, where the date of the first nest initiation was noted as day 1. We delineated subsequent nest attempts based on the number of days after the first nest was initiated. We subtracted the initiation day of the second nest from the initiation day of the first nest, and then subtracted the initiation day of the third nest from the initiation day of the second nest, and so on for each first nest attempt within each social group. We then calculated mean number of days between each nest initiation attempt within each social group. We speculated that social groups with more individuals would have more days between subsequent nest attempts compared to smaller groups. Presumably, larger groups would contain more females competing to copulate with dominant males (Orbach et al. 2015), whereas smaller groups would have less competition and thus be able to copulate in a shorter temporal window, resulting in a narrower time window during which nests were initiated by females in that group (Dewsbury 1982, Foster 1983, Avery 1984, Trail 1985, Gratson et al. 1991, Moller 1992).

Females that attempt reproduction earlier within a season are expected to have greater annual reproductive success compared to later breeding individuals (Lack 1968, Perrins 1970) and previous research has noted that in lekking birds, dominant females breed first (Robel and Ballard 1974, Foster 1983). Dominant females can presumably select nest sites that could confer fitness advantages through improved nest success (Sæther 1990, Martin 1995*a* , Martin 1995*b*), compared to subordinate females that nest later and may be forced to nest in suboptimal parts of their ranges or travel farther distances to find suitable nest sites. To test the prediction that dominant females would travel shorter distances within their ranges prior to onset of nest initiation, we used the distance between a female's nest location and the centroid of the UD range of the 21-day period before the first nest of each social group was initiated as our metric. We measured the distance between the centroid of each female's 99% UD range to each of her nest attempts in ArcGIS 10.6 (Environmental Systems Research Institute, Inc., Redlands, California, USA; Figure 1). To locate the centroids of each 99% UD, we calculated the x and $y$centroid of each UD in the attribute table. We then created a line between each nest attempt and the centroid and calculated the distance between each nest attempt within the 99% UD. To test for differences in mean distance traveled for females with successful versus failed nests, we used an independent 2-group t -test with an α=0.05 in R (R Core Team 2020). Likewise, we used a binomial generalized linear model (GLM) in R (R Core Team 2020) to estimate nest success as a function of first nest initiation date. We then used a Poisson GLM to estimate the rate (in days) at which females left their social groups and initiated their first and second nesting attempts as a function of group size and year. Finally, we used linear regression to evaluate the effect of social group size on the number of days between nesting attempts within social groups.

Results

We captured and radio-marked 225 female turkeys (201 adults, 24 juveniles) during 2014-2019. We monitored 245 nesting attempts (158 first, 69 second, 17 third, and 1 fourth nest attempt, respectively) from 158 females during 2014-2019. We identified 30 social groups with an average of 7 females per group (Table 1). Across all social groups and years, mean proportion of individual ranges during the 21-day period prior to first nest initiation that did not overlap was 7.18%. We identified 6 subgroups of 2–3 females that separated from larger social groups (Figure 2). Within social groups, we observed that [?]80% of females maintained ranges that overlapped during the 21-day period prior to nest initiation (Figure 3). Mean distance from the 21-day range centroid to the subsequent nest location ranged from 974 to 6403 m (Table 1) and averaged 2107 m (SD = 2131) across all females. Mean distance from the centroid within the 21-day range to the first nest attempt for successful (mean =1743 m, SD = 1175) and unsuccessful nests (mean = 2154 m, SD = 2236) was similar (t = -1.28, df = 46,P = 0.205). We identified 15 instances of females whose initial nest failed and they rejoined their social group, appearing to reinsert themselves into the reproductive hierarchy over remaining subordinate females that had not initiated a nest.

Across all years, mean date of first nest initiation was 12 April (SE = 1.2, range = 12 March – 23 May, median = 10 April). Within a social group, earliest mean date of first nest initiation was 24 March (SE = 10.5, range = 14 March – 4 April, median = 24 March) whereas latest mean date was 6 May (SE = 4, range = 2 – 10 May, median = 6 May; Table 1, Figure 4). We found that number of days between subsequent nest attempts was negatively (β = -0.993, SE = 0.0.285, P<0.01) influenced by group size (Figure 5). For all years, there were 21 successful first nest attempts (14% nest success), of which 6 (29%) were first nests initiated within the respective social group, and mean date of initiation for successful first nest attempts was 7 April. Our findings suggest that ˜30% of successful initial first nests were produced by ˜4% of females we presumed to be dominant within their respective social groups. We failed to detect a statistical difference in nest success relative to date of nest initiation (β = -0.011, SE = 0.021, P = 0.58).

We observed that the mean number of days between successive first nest attempts by females within a social group varied from 3 to 7 days across years [mean = 3.9 (SE = 0.5) in 2014; mean = 3.0 (SE = 0.5) in 2015; mean = 7.4, (SE = 0.7) in 2016; mean = 4.2 (SE = 0.3) in 2017; mean = 4.6 (SE = 0.4) in 2018; means = 7.2 (SE= 0.5) in 2019]. Mean number of days between first nest attempts by females within a social group was 49% less for successful (mean = 2.8, SE = 0.4) than failed (5.5, SE = 0.2) attempts (z = -4.51, P < 0.001).

Discussion

Our current understanding of social behavior in wild turkeys is based on visual observations of interactions during the breeding season (Watts and Stokes 1971, Healy 1992). We used high resolution movement data to assess social behaviors coupled with timing of nest initiation to infer social rank amongst females, and provide an alternative approach to infer behaviors and evaluate reproductive synchrony in wild turkeys (Bakner et al. 2019, Lohr et al. 2020). We found that female wild turkeys had social organization within flocks, likely maintained by social hierarchies that influence behaviors of individuals throughout their lives (Watts and Stoke 1971, Healy 1992). Our findings offer evidence that social dominance may influence timing of reproduction in wild turkeys, and subsequently influence individual reproductive success.

We found that female wild turkeys rarely left social groups prior to initiation of their first nest attempts. Similarly, Badyaev et al. (1996*a*) observed that female wild turkeys in Arkansas typically left their winter flocks at the same time regardless of physiological factors or age. We also found that prior to the onset of nest initiation, >80% of females within social groups overlapped ranges, so clearly females within social groups spatially constituted a single social unit (Brown 1975). Stable social groups have been observed in multiple avian species, including female black grouse (*Lyrurus tetrix tetrix*) who frequently occupied the same territory while foraging (Kruijt and Hogan 1967). Similarly, groups of female greater prairie chickens (*Tympanuchus cupido pinnatus*) exhibited social interactions during visits to leks (Robel and Ballard 1974) and female sage grouse (*Centrocercus urophasianus*) maintained social hierarchies that influenced timing of reproduction (Scott 1942).

We observed that timing of the onset of first nest initiation at the population level (e.g., across our study site) was similar across years. Researchers have noted similar observations previously, and attributed synchronous nesting behaviors at the population level to the potential that photoperiod most influences timing of reproduction (Healy 1992, Migaud et al. 2006, Walton et al. 2011). We also noted that average dates of first nest initiation for female wild turkeys on our site were comparable to dates reported across populations throughout the southeastern United States (Thogmartin and Johnson 1999, Palmer et al. 2013, Crawford et al. 2021). Conversely, within social groups we found substantive temporal variation in timing of nest initiation within years. Because social rank can dictate access to mates in species with pronounced dominance hierarchies, the fact that asynchronous nesting occurred within social groups on our study site was not surprising (Robel and Ballard 1974, Foster 1981, Webster 1994). We also observed that ~30% of successful initial first nests were produced by ~4% of females in our population, females we presumed to be dominant within their respective social groups. We note that these initial first nests by default were successful early in the nesting season, and previous works have noted the importance of successful early nesting attempts in sustaining wild turkey populations (Porter et al. 1983, Crawford et al. 2021). Contemporary literature has detailed the ecological significance of having females be successful at hatching clutches early in the nesting season for various species, including willow ptarmigan (*Lagopus lagopus* ; Wilson et al. 2007) and greater sandhill cranes (*Antigone canadensis* ; Ivey and Dugger 2008).

Within social groups, we expected 1–2 days to occur between each female initiating their first nest attempt, based on observations of nesting behaviors in captive wild turkeys detailed in Healy (1992). However, we found that on average, 3–7 days elapsed between successive nest attempts by individual females within a social group. We acknowledge that we have no way of confirming that we captured the dominant female within each social group, and recognize that we didn't capture all individuals in every social group we studied. However, we offer that it's reasonable to assume that dominance hierarchies existed within the social groups we monitored, and that these hierarchies influenced timing of nest initiation across females. Robel and Ballard (1974) noted that disruption of subordinate female greater prairie chickens by dominant females caused 2-3 day delays in copulation. Logically, disruption could increase time between successive nest attempts across subordinate females within a group, which may ultimately benefit dominant females if copulation was delayed in subordinate females or if they were forced to mate with inferior males (Foster 1981, Bro-Jørgensen 2002). However, female disruption only offers a partial explanation for the delay between successive nest attempts we observed. In lekking species, females are constrained in mate choice, and disruption of copulations between females and dominant males can occur via harassment from low-ranking males, which also could delay nesting (Foster 1983, Trail 1985). Likewise, if females are forced to travel farther to find suitable dominant males or return to breeding areas repeatedly to copulate with those same males, onset of nesting could be delayed (Alatalo et al. 1988).

Our findings suggest that larger social groups tended to exhibit more synchronized nest initiation, that number of days nest attempts across females declined as group size increased, and that more synchronized nesting attempts within a social group (as determined by days between nest attempts across females) resulted in greater probability of nest success. Previous research has demonstrated that larger male coalitions of wild turkeys attract more breeding opportunities through improved mate attraction relative to smaller coalitions (Krakauer 2008), which also has been observed in other species that use forms of leks (Jiguet and Bretagnolle 2006, Ryder et al. 2009). Likewise, in various species including wild turkeys, larger male coalitions are typically associated with larger social groups of females, are socially dominant over smaller coalitions, and would contain the highest ranked males within the breeding population (Watts and Stokes 1971, Krakauer 2005, Bygott et al. 1979). Conversely, smaller groups of female wild turkeys are often associated with pairs of subordinate males or singletons (Watts and Stokes 1971). In species with pronounced social hierarchies, breeding with dominant males confers females with fitness benefits such as greater reproductive success (Wong and Candolin 2005, Majolo et al. 2012), offering a partial explanation for our observation that nest success was greater in larger groups with improved nesting synchrony. Lastly, in birds where females aggregate into social groups, reproductive success in general may be positively associated with group size (Burger 1979, Canestrari et al. 2008).

Previous works noted that female wild turkeys typically nested within ~4 km of their winter range (Vander Haegen 1988, Badyaev and Faust 1996). Wild turkeys often shift ranges and exhibit temporal variation in resource selection as winter flocks dissolve and females move to breeding areas (Badyaev et al. 1996*b* , Miller and Conner 2007, Little et al. 2016). We found that females located first nest attempts an average of 2,107 m from the centroid of their 21-day range prior to nest initiation, a considerably shorter distance than reported by Badyaev et al. (1996*a*) specific to distances from nest sites to center of winter ranges. We predicted that dominant females would move shorter distances than subordinate females between the center of their 21-day range and their initial nest location, but our findings did not support this prediction. Likewise, we found that distances between nest sites and the centroid of the 21-day range before nest initiation failed to influence nest fate. This finding contradicts Badyaev et al. (1996*b*) who reported that females that traveled greater distances between pre-nesting ranges and their eventual nest site had greater nest success.

Our findings suggest that dominance hierarchies within social groups may influence timing of nest initiation in female wild turkeys. Established social bonds among individuals within social groups may be maintained throughout multiple seasons (Brandl et al. 2019). Thus, individuals in the same winter flocks are more likely to become members of social groups prior to breeding (Riehl 2011, Watkins et al. 2022), and subsequently reproduce in areas near other group members (Liu et al. 2013, Firth and Sheldon 2016). The genetic structure of social groups can have important implications for fitness, as emerging evidence suggests that females identify a cost to association with kin during the early reproductive season (Watkins et al. 2022). We suggest future research evaluating potential influences of sociality and dominance on nest success also incorporate genetic data on individuals within social groups, as sociality may also influence genetic variation, and therefore may play an important role in reproductive success (Sugg et al. 1996).

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CONFLICTS OF INTEREST

None.

AUTHOR CONTRIBUTION

Erin Ulrey: Data curation (lead); Formal analysis (supporting); Investigation (supporting); Methodology (supporting); Software (supporting); Visualization (supporting); Writing-original draft (lead). Michael J. Chamberlain: Conceptualization (supporting); Investigation (supporting); Methodology (supporting); Writing-original draft (supporting). Bret Collier: Conceptualization (supporting); Funding acquisition (lead); Methodology (supporting); Project administration (lead); Supervision (lead); Writing-review & editing (supporting).

ETHICAL APPROVAL

This research was conducted with approval from the Institutional Animal Care and Use Committee at the Louisiana State University Agricultural Center (Protocol #A2014-013 and A2015-07).

DATA AVAILABILITY STATEMENT

The data files for used in all analyses along with metadata are available upon request, or will be available on Dryad.

Literature Cited

Alatalo, R. V., A. Carlson, and A. Lundberg. 1988. The search cost in mate choice of the pied flycatcher. Animal Behavior 36:289-291.

Alexander, R. D. 1974. The evolution of social behavior. Annual Review of Ecology and Systematics 5:325–383.

Avery, M. I. 1984. Lekking in birds: choice, competition and reproductive constraints. Ibis 126: 177-187.

Badyaev, A. V., and J. D. Faust. 1996. Nest site fidelity in female wild turkey: potential causes and reproductive consequences. Condor 98:589–594.

Badyaev, A. V., W. J. Etges, and T. E. Martin. 1996*a* . Ecological and behavioral correlates of variation in seasonal home ranges of wild turkeys. Journal of Wildlife Management 60:154–164.

Badyaev, A. V., T. E. Martin, and W. J. Etges. 1996*b* . Habitat sampling and habitat selection by female wild turkeys: ecological correlates and reproductive consequences. The Auk 113:636–646.

Badyaev, A. V., W. J. Etges, J. D. Faust, and T. E. Martin. 1998. Fitness correlates of spur length and spur asymmetry in male wild turkeys. Journal of Animal Ecology 67:845–852.

Bakner, N. W., L. R. Schofield, C. Cedotal, M. J. Chamberlain, and B. A. Collier. 2019. Incubation recess behaviors influence nest survival of wild turkeys. Ecology and Evolution 9:14053–14065.

Brandl, H. B., S. C. Griffith, and W. Schuette. 2019. Wild zebra finches choose neighbours for synchronized breeding. Animal Behavior 151:21–28.

Bro-Jørgensen, J. 2002. Overt female mate competition and preference for central males in a lekking antelope. Proceedings of the National Academy of Sciences 99:9290-9293.

Brown, J. L. 1975. The evolution of behavior. W. W. Norton and Co., Inc., New York, N. Y. 761pp.

Buchholz, R. 1995. Female choice, parasite load and male ornamentation in wild turkeys. Animal Behaviour 50:929–943.

Buchholz, R. 1997. Male dominance and variation in fleshy head ornamentation in wild turkeys. Journal of Avian Biology 28:223– 230.

Burger, J. 1979. Colony size: a test for breeding synchrony in herring gull (*Larus argentatus*) colonies. The Auk 96:694-703.

Bygott, J. D., B. C. R. Bertram, and J. P. Hanby. 1979. Male lions in large coalitions gain reproductive advantages. Nature 282:839-841.

Byrne, M. E., J. C. McCoy, J. W. Hinton, M. J. Chamberlain, and B. A. Collier. 2014. Using dynamic Brownian bridge movement modelling to measure temporal patterns of habitat selection. Journal of Animal Ecology 83: 1234–1243.

Campomizzi, A. J., J. A. Butcher, S. L. Farrell, A. G. Snelgrove, B. A. Collier, K. J. Gutzwiller, M. L. Morrison, and R. N. Wilkins. 2008. Conspecific attraction is a missing component in wildlife habitat modeling. Journal of Wildlife Management 72:331–336.

Canestrari, D., J. M. Marcos, and V. Baglione. 2008. Reproductive success increases with group size in cooperative carrion cows,*Corvus corone corone* . Animal Behaviour 75:403-416.

Chamberlain, M. J., B. S. Cohen, N. W. Bakner, and B. A. Collier. 2020. Behavior and movement of wild turkey broods. Journal of Wildlife Management 84:1139-1152.

Chamberlain, M. J., P. H. Wightman, B. S. Cohen, and B. A. Collier. 2018. Gobbling activity of eastern wild turkeys relative to male movements and female nesting phenology in South Carolina. Wildlife Society Bulletin 42:632–642.

Cohen, B. S., T. J. Prebyl, B. A. Collier, and M. J. Chamberlain. 2018. Home range estimator method and GPS sampling schedule affect habitat selection inferences for wild turkeys. Wildlife Society Bulletin 42:150–159.

Collier, B. A., N. Fyffe, A. Smallwood, B. Oleson, N. W. Bakner, J. R. Heffelfinger, and M. J. Chamberlain. 2019. Reproductive ecology of Gould's wild turkeys (*Meleagris gallopavo mexicana*) in Arizona. The Wilson Journal of Ornithology 131:667-679.

Conley, M. D., J. G. Oetgen, J. Barrow, M. J. Chamberlain, K. L. Skow, and B. A. Collier. 2015. Habitat selection, incubation, and incubation recess ranges of nesting female Rio Grande wild turkeys in Texas. National Wild Turkey Symposium 11:117–126.

Conley, M. D., N. A. Yeldell, M. J. Chamberlain, and B. A. Collier. 2016. Do movement behaviors identify reproductive habitat sampling for wild turkeys? Ecology and Evolution 6:7103–7112.

Crawford, J. C., W. F. Porter, M. J. Chamberlain, and B. A. Collier. 2021. Wild turkey nest success in pine-dominated forests of the southeastern United States. Journal of Wildlife Management 85:498-507.

Cristol, D. A. 1995. Early arrival, initiation of nesting, and social status: an experimental study of breeding female red-winged blackbirds. Behavioral Ecology 6:87-93.

Danchin, E., T. Boulinier, and M. Massot. 1998. Conspecific reproductive success and breeding habitat selection: implications for the study of coloniality. Ecology 79:2415–2428.

Danchin, E., L. A. Giraldeau, T. J. Valone, and R. H. Wagner. 2004. Public information: from nosy neighbors to cultural evolution. Science 305: 487–491.

Darling, F. F. 1938. Bird flocks and breeding cycle. Cambridge University Press, Cambridge, United Kingdom.

Dewsbury, D. A. 1982. Dominance rank, copulatory behavior, and differential reproduction. The Quarterly Review of Biology 57:135-159.

Di Maggio, R., D. Campobello, and M. Sarà. 2013. Nest aggregation and reproductive synchrony promote lesser kestrel *Falco naumanni*seasonal fitness. Journal of Ornithology 154:901-910.

Doligez, B., E. Danchin, and J. Clobert. 2002. Public information and breeding habitat selection in wild bird population. Science 297:1168–1170.

Eaton, S. W. 1992. Wild Turkey. Number 22 *in* A. Poole, P. Stettenheim, and F. Gill, editors. The birds of North America. The Academy of Natural Sciences, Philadelphia, Pennsylvania, USA, and The American Ornithologists Union, Washington, D. C., USA.

Emlen, S. T., and N. J. Demong. 1975. Adaptive significance of synchronized breeding in a colonial bird: a new hypothesis. Science 188:1029–1031.

Emlen, S. T. 1976. Lek organization and mating strategies in the bullfrog. Behavioral Ecology and Sociobiology 1:283-313.

Emlen, S. T. and L. W. Oring. 1977. Ecology, sexual selection, and the evolution of mating systems. Science 197: 215–223.

Findlay C. S., and F. Cooke. 1982. Synchrony in the lesser snow goose (*Anser caerulescens caerulescens*). II. The adaptive value of reproductive synchrony. Evolution 36:786–799.

Firth, J. A., and B. C. Sheldon. 2016. Social carry-over effects underpin trans-seasonally linked structure in a wild bird population. Ecology Letters 19:1324-1332.

Forbes, L. S., and G. W. Kaiser. 1994. Habitat choice in breeding seabirds: when to cross the information barrier. Oikos 70:377–384.

Foster, M. S. 1981. Cooperative behavior and social organization of the swallow-tailed manakin (*Chiroxiphia caudate*). Behavioral Ecology and Sociobiology 9:167–177.

Foster, M. S. 1983. Disruption, dispersion, and dominance in lek-breeding birds. American Naturalist 122:53–72.

Gochfeld, M. 1980. Mechanism and adaptive value of reproductive synchrony in colonial seabirds. Pages 270-290 *in* J. Burger, B. L. Olla, and H. E. Winn, editors. Behavior of Marine Animals Vol. 4. Marine birds. Plenum Press, New York, N. Y.

Grant, J. W. A., and D. L. Kramer. 1992. Temporal clumping of food arrival reduces its monopolization and defence by zebrafish,*Brachydanio rerio* . Animal Behavior 44:101–110.

Gratson, M. W., G. K. Gratson, and A. T. Bergerud. 1991. Male dominance and copulation disruption do not explain variance in male mating success on sharp-tailed grouse (*Tympanuchus phasianellus*) leks. Behaviour:118: 187-213.

Guthrie, J. D., M. E. Byrne, J. B. Hardin, C. O. Kochanny, K. L. Skow, R. T. Snelgrove, M. J. Butler, M. J. Peterson, M. J. Chamberlain, and B. A. Collier. 2011. Evaluation of a Global Positioning System backpack transmitter for wild turkey research. Journal of Wildlife Management 75:539–547.

Healy, W. M. 1992. Behavior. Pages 46-65 *in* J. G. Dickson, editor. The wild turkey: biology and management. National Wild Turkey Federation, Harrisburg, Pennsylvania, USA.

Helm, B. T. Piersma, H. van der Jeugd. 2006. Sociable schedules: interplay between avian seasonal and social behavior. Animal Behavior 72:245–262.

Ims, R. A. 1990. The ecology and evolution of reproductive synchrony. Trends in Ecology and Evolution 5:135–140.

Ivey, G. L., and B. D. Dugger. 2008. Factors influencing nest success of greater sandhill cranes at Malheur National Wildlife Refuge, Oregon. Waterbirds 31:52-61.

Jiguet, F., and V. Bretagnolle. 2006. Manipulating lek size and composition using decoys: an experimental investigation of lek evolution models. The American Naturalist 168:758-768.

Kernohan, B. J., R. A. Gitzen, and J. J. Millspaugh. 2001. Analysis of animal space use and movements. Pages 125–166 *in* J.H. Millspaugh and J. M. Marzluff, editors. Radio tracking animal populations. Academic Press, San Diego, California, USA.

Knowlton, N. 1979. Reproductive synchrony, parental investment, and the evolutionary dynamics of sexual selection. Animal Behavior 27:1022–1033.

Krakauer, A. H. 2005. Kin selection and cooperative courtship in wild turkeys. Nature 434:69-72.

Krakauer, A. H. 2008. Sexual selection and the genetic mating system of wild turkeys. Condor 110:1-12.

Kranstauber, B., and M. Smolla. 2013. Move: Visualizing and analyzing animal track data. Free R-software package.

Kruijt, J. P., and J. A. Hogan. 1967. Social behavior on the lek in black grouse, *Lyrurus tetrix tetrix* (L.). Ardea 55: 204–240.

Lack, D. 1968. Ecological adaptations for breeding in birds. Methuen, London.

Little, A. R., M. J. Chamberlain, L. M. Conner, and R. J. Warren. 2016. Habitat selection of wild turkeys in burned longleaf pine savannas. Journal of Wildlife Management 80:1280-1289.

Liu, Y., I. Keller, and G. Heckel. 2013. Temporal genetic structure and relatedness in the tufted duck *Aythya fuligula* suggests limited kin association in winter. Ibis 155:499-507.

Lohr, A. K., J. A. Martin, G. T. Wann, B. S. Cohen, B. A. Collier, and M. J. Chamberlain. 2020. Behavioral strategies during incubation influence nest and female survival of wild turkeys. Ecology and Evolution 10:11752-11765.

Mackenzie, A., J. D. Reynolds, V. J. Brown, and W. J. Sutherland. 1995. Variation in male mating success on leks. American Naturalist 145:633–652.

Majolo, B., J. Lehmann, A. de Bortoli, and G. Schino. 2012. Fitness-related benefits of dominance in primates. American Journal of Biological Anthropology 147:652-660.

Martin, K. 1995*a* . Patterns and mechanisms for age-dependent reproduction and survival in birds. American Zoologist 35:340–348.

Martin, T. E. 1995*b* . Avian life history evolution in relation to nest sites, nest predation, and food. Ecological Monographs 65:101–127.

Migaud, H., N. Wang, J. Gardeur, and P. Fontaine. 2006. Influence of photoperiod on reproductive performances in Eurasian perch *Perca fluviatilis* . Aquaculture 252:385-393.

Miller, D. A., and L. M. Conner. 2007. Habitat selection of female turkeys in a managed pine landscape in Mississippi. Journal of Wildlife Management 71:744-751.

Möller, A. P. 1992. Frequency of female copulations with multiple males and sexual selection. American Naturalist 139: 1089-1101.

Orbach, D. N, G. G. Rosenthal, and B. Würsig. 2015. Copulation rate declines with mating group size in dusky dolphins (*Lagenorhynchus obscurus*). Canadian Journal of Zoology 93: 503-507.

Palmer, W. E., S. R. Priest, R. S. Seiss, P. S. Phalen, and G. A. Hurst. 1993. Reproductive effort and success in a declining wild turkey population. Proceedings of the Southeastern Association of Fish and Wildlife Agencies 47:138–147.

Pelham, P. H., and J. G. Dickson. 1992. Physical characteristics. Pages 32 – 45 *in* J. G. Dickson, editor. The wild turkey: biology and management. National Wild Turkey Federation, Harrisburg, Pennsylvania, USA.

Perrins, C. M. 1970. The timing of birds' breeding seasons. Ibis 112:242–255.

Porter, W. F., G. C. Nelson, and K. Mattson. 1983. Effects of winter conditions on reproduction in a northern wild turkey population. Journal of Wildlife Management 47:281–290.

Post, W. 1992. Dominance and mating success in male boat-tailed grackles. Animal Behaviour 44:917-929.

Riehl, C. 2011. Living with strangers: direct benefits favour non-kin cooperation in a communally nesting bird. Proceedings of Royal Society B 278:1728-1735.

Ringgenberg, N., E. K. F. Fröhlich, A. Harlander-Matauschek, M. J. Toscano, H. Würbel, and B. A. Roth. 2015. Nest choice in laying hens: effects of nest partitions and social status. Applied Animal Behavior Science 169:43-50.

Robel, R. J. 1970. Possible role of behavior in regulating Greater Prairie Chicken populations. Journal of Wildlife Management 34:306–312.

Robel, R. J., and W. B. Ballard Jr. 1974. Lek social organization and reproductive success in the Greater Prairie Chicken. American Zoologist 14: 121-128.

Ryder, T. B., P. G. Parker, J. G. Blake, and B. A. Loiselle. 2009. It takes two to tango: reproductive skew and social correlates of male nesting success in a lek-breeding bird. Proceedings of the Royal Society B 276:2377-2384.

Sæther, B. E. 1990. Age-specific variation in reproductive performance of birds. Current Ornithology 7:251–283.

Schmutz, J. A., and C. E. Braun. 1989. Reproductive performance of Rio Grande wild turkeys. Condor 91:675-680.

Scott, J. W.1942. Mating behavior of the sage grouse. The Auk 59:477–498.

Stamps, J. A. 1988. Conspecific attraction and aggregation in territorial species. American Naturalist 131:329–347.

Strong, M. J., B. L. Sherman, and C. Riehl. 2018. Home field advantage, not group size, predicts outcomes of intergroup conflicts in a social bird. Animal Behaviour 143:205-213.

Sugg, D. W., R. K. Chesser, F. S. Dobson, & J. L. Hoogland. 1996. Population genetics meets behavioral ecology. Trends in Ecology and Evolution 11:338-342.

Thogmartin, W. E. 2001. Home-range size and habitat selection of female wild turkeys in Arkansas. American Midland Naturalist 145:247–260.

Thogmartin, W. E., and J. E. Johnson. 1999. Reproduction in a declining population of wild turkeys in Arkansas. Journal of Wildlife Management 63:1281–1290.

Trail, P. W. 1985. Courtship disruption modifies mate choice in a lek-breeding bird. Science 227:778-780.

Vander Haegen, W. M., W. E., Dodge, and M. W. Sayre. 1988. Factors affecting productivity in a northern wild turkey population. Journal of Wildlife Management. 52:127–133.

Walton, J. C., Z. M. Weil, and R. J. Nelson. 2011. Influence of photoperiod on hormones, behavior, and immune function. Frontiers in Neuroendocrinology 32:303-319.

Wakefield, C. T., P. H. Wightman, J. A. Martin, B. T. Bond, D. K. Lowrey, B. S. Cohen, B. A. Collier, M. J. Chamberlain. 2020. Hunting and nesting phenology influence gobbling of Eastern wild turkeys. Journal of Wildlife Management 84:448–457.

Watkins, S. A., J. A. Martin, B. VonHoldt, and M. J. Chamberlain. 2022. The role of kinship in sociality of female eastern wild turkeys (*Meleagris gallopavo silvestris*). Ornithology. In review.

Watts, C. R., and A. W. Stokes. 1971. The social order of turkeys. Scientific American 224: 112–118.

Webster, M. S. 1994. The spatial and temporal distribution of breeding female *Montezuma Oropendolas* : effects on male mating strategies. Condor 96:722–733.

Williams, L. E., and D. H. Austin. 1988. Studies of the wild turkey in Florida. Florida Game and Fresh Water Fish Commission Technical Bulletin 10.

Wilson, S., K. Martin, and S. J. Hannon. 2007. Nest survival patterns in willow ptarmigan: influence of time, nesting stage, and female characteristics. Condor 109:377–388.

Wong, B. B. M., and U. Candolin. 2005. How is female mate choice affected by male competition? Biological Review 80:559-571.

Wood, J. W., B. S. Cohen, L. M. Conner, B. A. Collier, and M. J. Chamberlain. 2019. Nest and brood site selection of eastern wild turkeys. Journal of Wildlife Management 83:192–204.

Yeldell, N. A., B. S. Cohen, A. R. Little, B. A. Collier, and M. J. Chamberlain. 2017. Nest site selection and nest survival of eastern wild turkeys in a pyric landscape. Journal of Wildlife Management 81:1073–1083.

Table 1. Number (No.) of female wild turkeys within each social group (S), number of nest attempts (n), number of first (1), second (2), third (3), and fourth (4) nesting attempts, mean date of first nest initiation (MeanInit) with associated standard deviation in parentheses, median date of first nest initiation (MedInit), range of dates of first nest initiation (R), mean number of days between first nest attempts (Days) with associated standard deviation in parentheses, mean distance (Dist, m) between each nest location and the centroid of 99% utilization distributions 21 days prior to the first nest attempt on Kisatchie National Forest and Peason Ridge WMA in west-central Louisiana, USA during 2014–2019.

Year	**S**	**No.**	**n**	**1**	**2**	**3**	**4**	**MeanInit**	**MedInit**	**R**	**Days**	**Dist**
2014	1	9	9	5	4	0	0	4/23 (5.1)	4/21	4/17 – 4/29	3 (3.2)	2883
	2	7	7	4	2	1	0	4/13 (17.5)	4/10	3/28 - 5/5	12.7 (7.6)	3493
	3	7	6	4	2	0	0	4/23 (5.9)	4/23	4/17 – 5/1	4.7 (1.5)	983
	4	3	5	2	1	1	1	4/13 (6.5)	4/13	4/9 – 4/18	9	2895
	5	2	2	2	0	0	0	5/6 (5.7)	5/6	5/2 – 5/10	8	1234
	6	4	5	3	2	0	0	4/12 (3.5)	4/12	4/9 – 4/16	3.5 (0.7)	1767
2015	7	7	5	4	1	0	0	4/14 (17.2)	4/15	3/25 – 5/3	13 (3)	3754
	8	4	5	3	2	0	0	4/3 (6.4)	4/1	3/30 – 4/11	6 (5.7)	2709
	9	3	3	2	1	0	0	4/3 (8.5)	4/3	3/28 – 4/9	12	2093
	10	8	14	7	4	3	0	4/5 (8.7)	4/7	3/20 – 4/15	4.3 (3.3)	1912
2016	11	9	12	9	3	0	0	4/23 (16.2)	5/1	4/9 – 5/1	5.3 (6.0)	2228
	12	3	3	2	1	0	0	4/9 (20.5)	4/9	3/26 – 4/24	29	2681
	13	9	6	5	1	0	0	4/24 (10.4)	4/28	4/9 – 5/1	7.3 (8.1)	1697
	14	6	4	3	1	0	0	4/30 (14.5)	5/8	4/24 – 5/10	13 (15.6)	1293
2017	15	13	15	11	3	1	0	4/1 (7.9)	4/1	3/19 – 4/15	2.7 (2.0)	1179
	16	12	16	10	6	0	0	4/4 (15.1)	3/29	3/20 – 5/5	5.1 (6.0)	2741
	17	5	8	5	3	0	0	3/25 (9.1)	3/29	3/12 – 4/5	6.0 (4.2)	1940
	18	9	8	6	1	1	0	4/15 (8.5)	4/15	4/2 – 4/27	5.0 (3.9)	6403
	19	3	5	3	2	0	0	4/19 (10.3)	4/22	4/8 – 4/28	10.0 (5.7)	1421
	20	9	7	6	1	0	0	4/11 (8.5)	4/8	4/2 – 4/23	4.2 (3.6)	974
	21	6	8	5	3	0	0	4/10 (10.1)	4/8	3/29 – 4/26	7.0 (6.8)	1437
	22	13	12	7	4	1	0	4/19 (16.0)	4/26	3/27 – 5/8	7.0 (6.2)	1555
	23	11	10	8	1	1	0	4/22 (13.4)	4/22	4/8 – 5/15	5.3 (4.1)	1330
	24	3	3	3	0	0	0	3/24 (14.9)	3/24	3/14 – 4/4	21	1637
2018	25	15	19	12	5	2	0	4/14 (14.0)	4/12	3/29 – 5/10	3.8 (2.6)	1652
	26	3	3	2	1	0	0	4/22 (17.7)	4/22	4/10 – 5/5	25	3395
2019	27	10	14	7	4	3	0	4/6 (11.4)	4/6	3/21 – 4/24	5.7 (3.3)	2030

Year	S	No.	n	1	2	3	4	MeanInit	MedInit	R	Days	Dist
	28	7	10	7	2	1	0	4/5 (23.2)	3/26	3/19 – 5/23	10.9 (13.9)	2486
	29	7	14	6	6	2	0	3/30 (14.1)	3/27	3/16 – 4/24	7.8 (5.4)	2046
	30	9	7	5	2	0	0	4/10 (15.3)	4/3	3/28 – 5/5	9.5 (8.6)	1916

Table 2. Number of female eastern wild turkeys (*Meleagris gallopavo silvestris*) within each social group (#), mean day of first nest initiation, and range of first nest initiation days (Range) with associated standard deviations (SD) where day 1 is the first nest initiation by a female within a social group on Kisatchie National Forest and Peason Ridge WMA in west-central Louisiana during 2014 – 2019.

Year	Social Group	#	Mean Day (SD)	Range
2014	1	9	7.2 (5.1)	1-13
	2	7	17 (17.5)	1-39
	3	7	7.75 (5.9)	1-15
	4	3	5.5(6.4)	1-10
	5	2	5 (5.7)	1-9
	6	4	4.33(3.5)	1-8
2015	7	7	21.25 (17.2)	1-40
	8	4	5.67 (6.4)	1-13
	9	3	7 (8.5)	1-13
	10	8	17 (8.7)	1-27
2016	11	9	23.4 (16.2)	1-43
	12	3	15.5 (20.5)	1-30
	13	9	16 (10.4)	1-23
	14	6	17.67 (14.5)	1-27
2017	15	13	14.82 (7.9)	1-28
	16	12	16.1 (15.1)	1-47
	17	5	14.6 (9.1)	1-25
	18	9	14.83 (8.5)	1-26
	19	3	12.33 (10.3)	1-21
	20	9	10.17 (8.5)	1-22
2018	21	6	13.2 (10.1)	1-29
	22	13	24.43 (16.0)	1-43
	23	11	15.88 (13.4)	1-38
	24	3	11.5 (14.9)	1-22
	25	15	17.17 (14.0)	1-43
	26	3	13.5 (17.7)	1-26
2019	27	10	17.28 (11.4)	1-35
	28	7	18.57 (23.2)	1-66
	29	7	15.83 (14.1)	1-40
	30	9	14 (15.3)	1-39

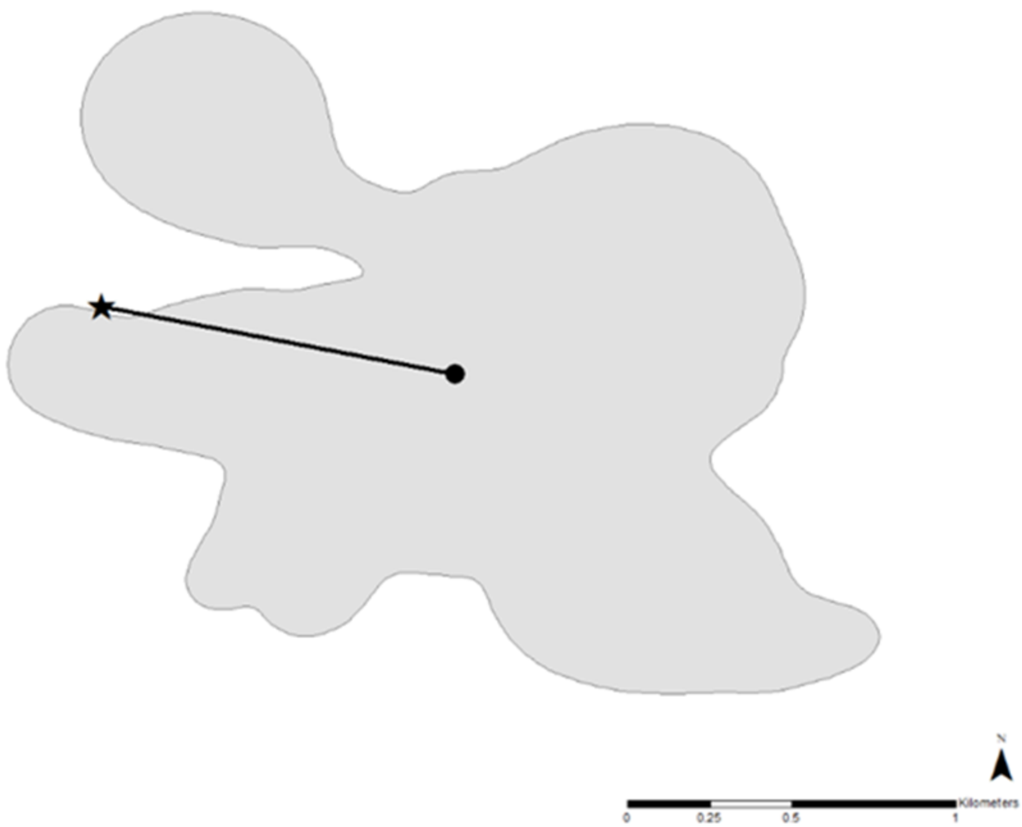
Figure 1. Straight-line distance (km) between the centroid (black dot) within the 99% utilization distribution of a female eastern wild turkey and her initial nest attempt (star) on Peason Ridge Wildlife Management Area, Louisiana during 2019.

Figure 2. Utilization distributions (99%) for a social group of female eastern wild turkeys during the 21-day period prior to the first nest initiation attempt by the presumed dominant female on Peason Ridge Wildlife Management Area, Louisiana during 2017.

Figure 3. Proportion of female wild turkey ranges that overlapped [?] 1 other female's range within their respective social groups during the 21-day period prior to initiation of first nest attempts on Kisatchie National Forest and Peason Ridge Wildlife Management Area, west-central Louisiana, USA during 2014-2019.

Figure 4. Range of first nest initiation dates of female eastern wild turkeys (*Meleagris gallopavo silvestris*) during 2014-2019 on Kisatchie National Forest and Peason Ridge Wildlife Management Area, west-central Louisiana, USA.

Figure 5. Dot plot of the mean number of days between first nest attempts of female eastern wild turkeys (*Meleagris gallopavo silvestris*) within social groups relative to size of each social group on Kisatchie National Forest and Peason Ridge WMA, west-central Louisiana, USA during 2014-2019. Plot suggests that larger social groups have more synchronous initial nest attempts than smaller groups.


N
Kilometers
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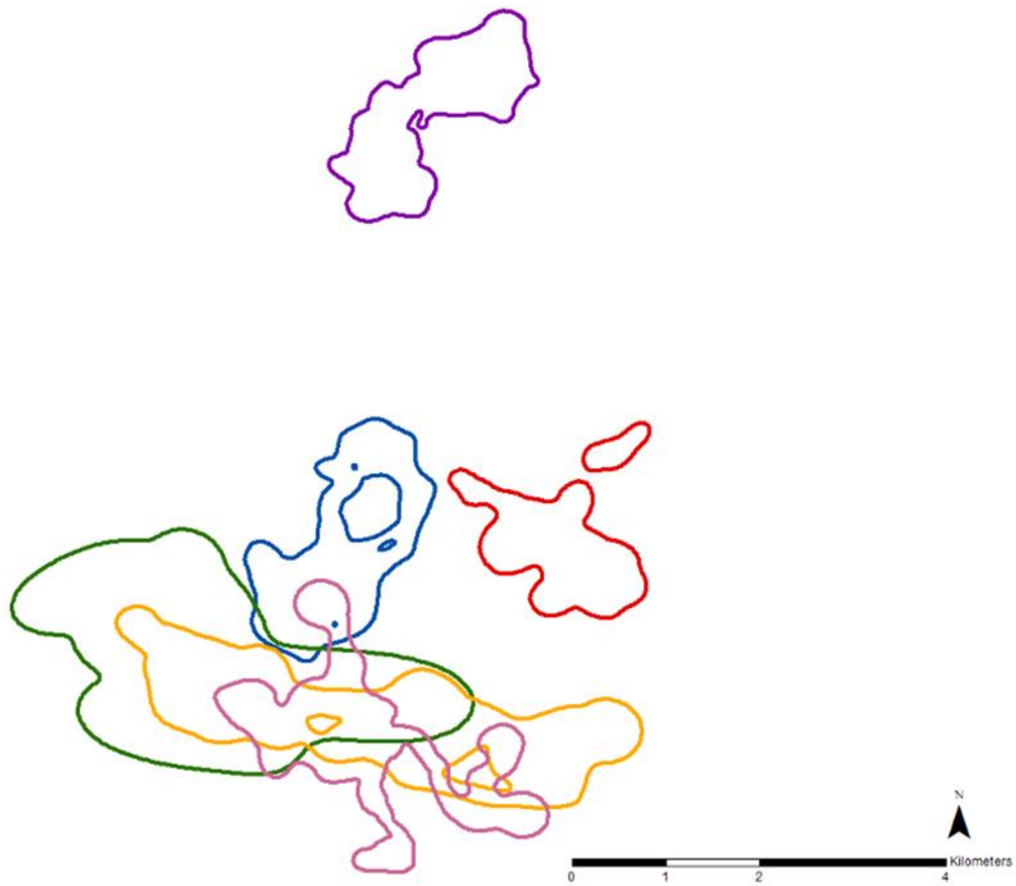
1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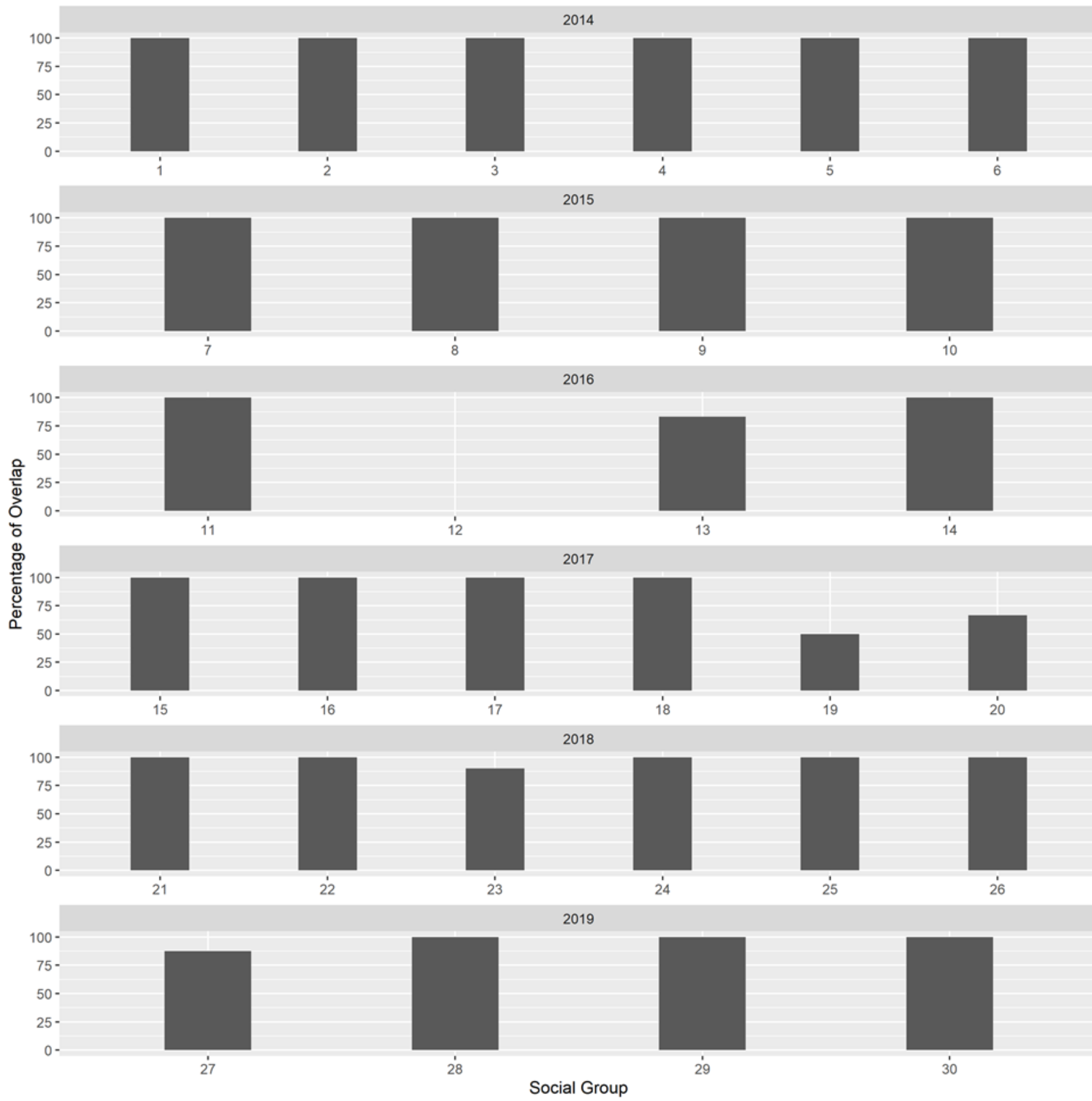
2014
2015
2016
2017
2018
2019
100
75
50
25
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1
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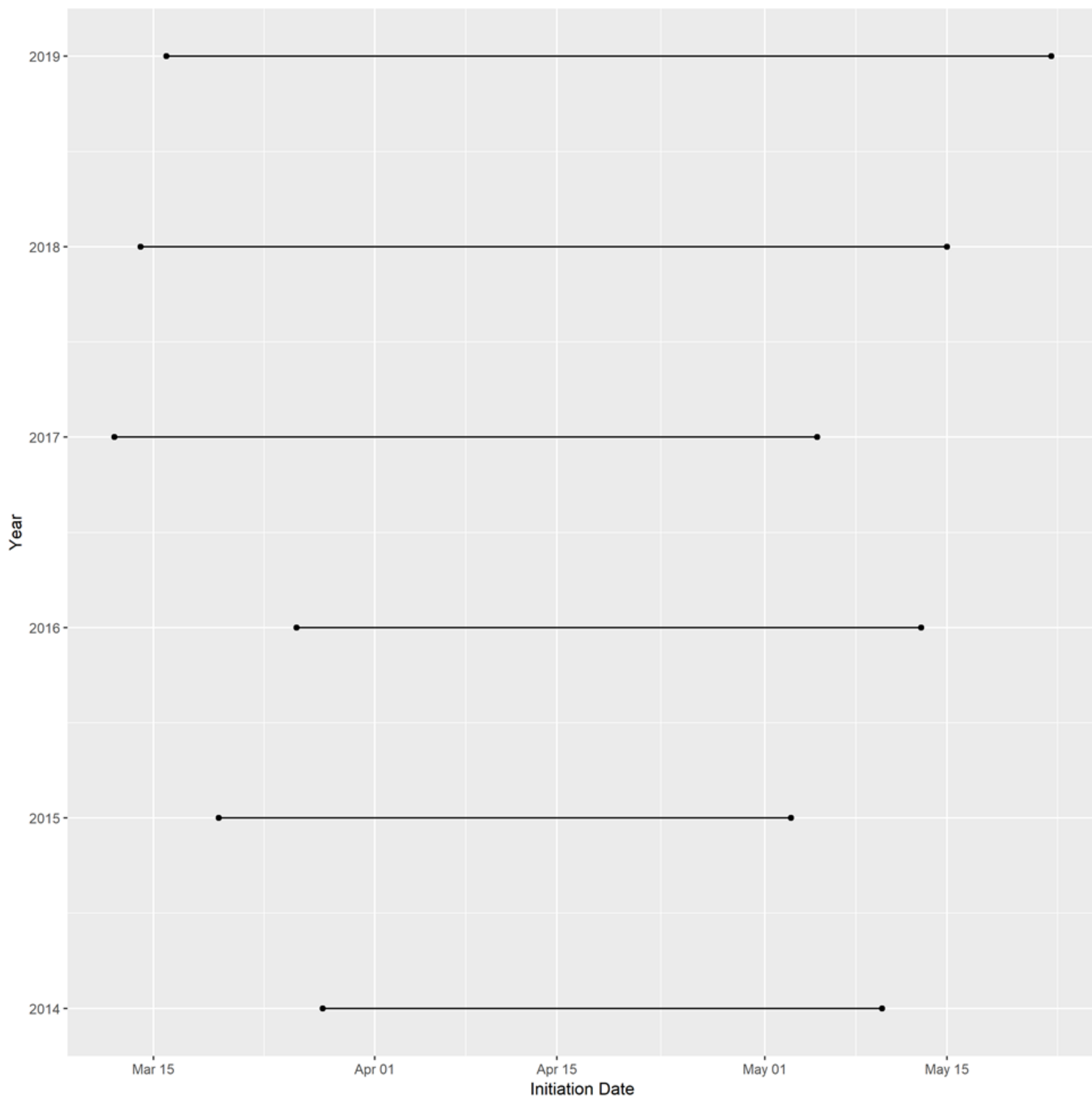
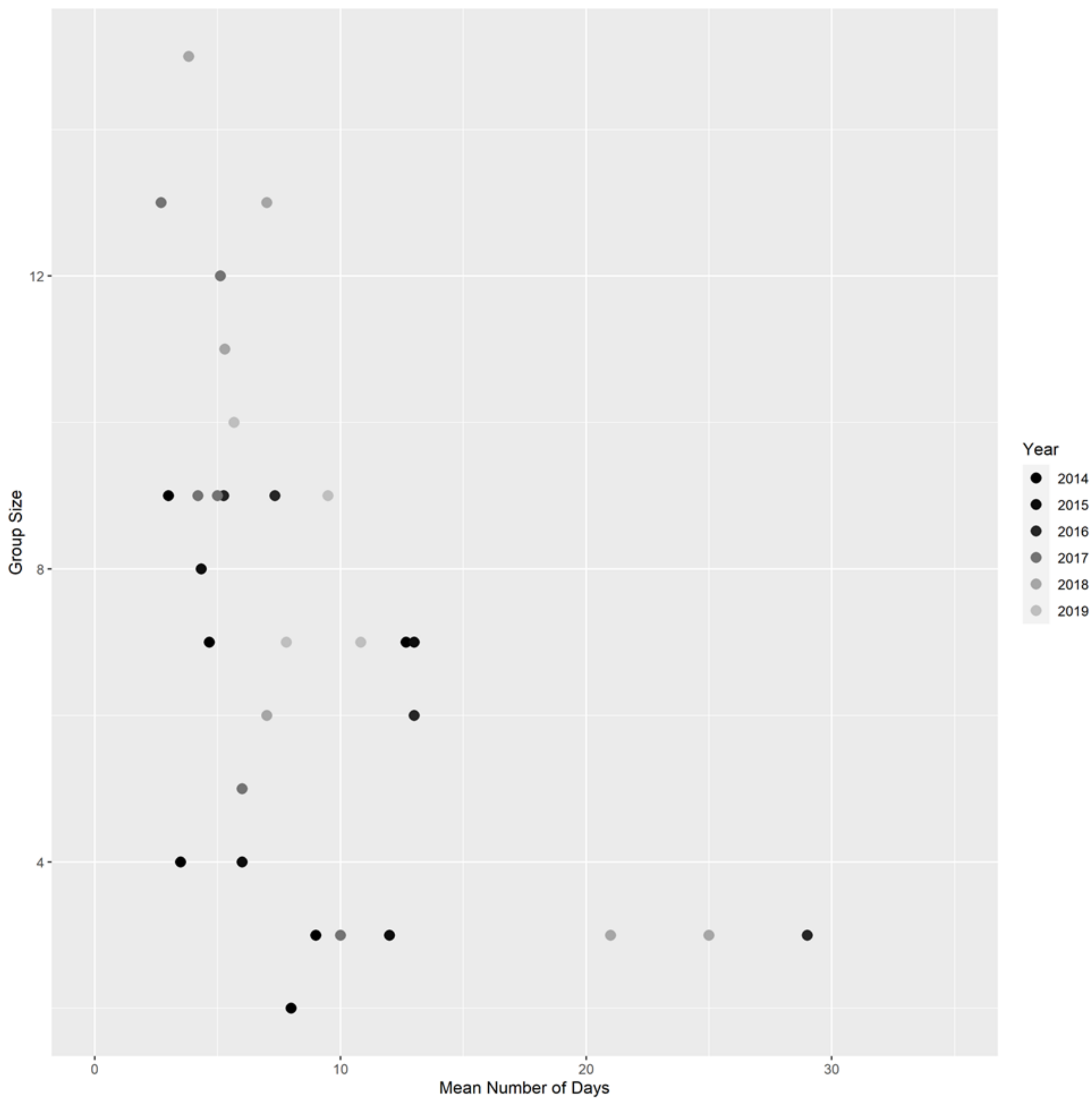
Percentage of Overlap
Social Group



Year
2019
2018
2017
2016
2015
2014
Mar 15
Apr 01
Apr 15
May 01
May 15
Initiation Date



Group Size
12
8
4
0
10
20
30
Mean Number of Days
Year
2014
2015
2016
2017
2018
2019