

Appendix from N. T. Wheelwright and C. Teplitsky, “Divorce in an Island Bird Population: Causes, Consequences, and Lack of Inheritance”

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Additional Details on Methods

Advantages of Studying Divorce in Kent Island Savannah Sparrows

There are several aspects of the biology of Savannah sparrows on Kent Island that make them especially well suited to exploring the dynamics of divorce. First, divorce is not confounded by a female’s efforts to improve her nest site or location, unlike in species that must compete for a restricted number of artificial nest boxes or territories that vary in suitability (Garcia-Navas and Sanz 2011; Bai and Severinghaus 2012). Because Savannah sparrows construct their nests on the ground, nest sites are effectively unlimited, and there is no evidence that females attempt to upgrade territories as they gain in age, breeding experience, or social status (Otter and Ratcliffe 1996). Second, issues such as asynchrony in arrival times or incomplete or erroneous information about mates are not as relevant in Savannah sparrows as in some other species (Gonzalez-Solis et al. 1999; Jeschke and Kokko 2008). Savannah sparrows are opportunistically polygynous, with 10%–40% of males in a given year attracting more than one mate, and males actively court every female encountered near their territories. Time constraints for completing breeding are not as narrow as in many species (Bried et al. 1999), so males do not reject even late-arriving females. Females usually spend several weeks recovering from migration before laying their first clutch, which gives them ample opportunity to assess prospective mates. Third, divorce is not merely a mechanism to avoid incest, as it appears to be in some species (Cockburn et al. 2003), because Savannah sparrows can recognize kin and almost never pair with close relatives (Wheelwright and Mauck 1998; Wheelwright et al. 2006). Finally, because of high natal and breeding philopatry, it is feasible to explore the influences of an individual’s parents on the likelihood of divorce and to measure fitness by lifetime production of recruits rather than merely the number of offspring fledged from the nest. About 11% of fledglings and 26% of independent juveniles born on Kent Island return to breed within 200 m of where they were born; once a bird selects a breeding territory, it rarely moves nest sites more than 30 m between years (Wheelwright and Mauck 1998).

Savannah sparrows on Kent Island have never been provisioned with food or artificial nest sites, or been hunted or managed. Ever since the island became a biological field station 82 years ago, the population has changed little in size, and its open habitat has remained in a natural state with relatively little plant succession.

Within-Season versus Between-Season Divorce

In multibrooded species such as Savannah sparrows, divorce can occur within or between seasons. However, between-season divorces in our study population were almost eight times as common as within-season divorces (general linear models [glmm] estimate = 2.64 ± 0.22 , $z = 12.01$, $P < .0001$). Females switched mates midseason in only 6% of successive breeding attempts ($N = 814$), presumably because in the middle of the breeding season females have fewer options to exchange mates than they do between years. Moreover, within the breeding season, females deter rival females from usurping their mates. Between-season divorces may also be more common than within-season divorces because of the simple physical separation of the pair and the erosion of the pair bond during the 8–9 months when the birds are away from the breeding grounds (note that males and females migrate separately and overwinter at different latitudes; Woodworth et al. 2016). Because of the infrequency and distinct dynamics of within-season divorces, in this article we follow Culina et al. (2014) in focusing on between-season divorces.

Breeding Success of Monogamous and Alpha Females

Alpha (primary) females mated to polygynous males turned out to have the same fledging success as monogamous females (with monogamous females as reference: polygynously mated alpha females: 0.01 ± 0.04 , $z = 0.25$, $P = .81$; polygynously mated beta [secondary] females: -0.22 ± 0.046 , $z = -4.76$, $P < .0001$).

Power Analyses

Power analyses were run for four values of additive genetic variance (0, 1, 2, and 3) using simulated data based on data sets restricted to the individuals for which divorce had occurred (i.e., for which we had information in the actual data set). We used 30 replicates per additive genetic variance value. Simulated phenotypes were obtained using pedantics (Morrissey 2009; Morrissey and Wilson 2010). The R code is given online.

The results of these simulations were analyzed visually by overlapping the posterior distributions of the observed data with the simulated posterior distributions of the four additive genetic variance values. There was little or no power to detect additive genetic variance. However, for observed data, the posterior distribution of the additive genetic variance has a very high density close to zero (fig. S5). This was also apparent for simulated values of $V_a = 0$ (simulations 2, 4, 9, 24) and $V_a = 1$ (simulations 10, 15, 30) and more rarely for higher simulated values of V_a (but see simulation 24). Although we had little power to detect significant genetic variance, this suggests that additive genetic variance could indeed exist at very low levels.