

Differentiating between the role of intrinsic and extrinsic factors dictating field sparrow (Spizella pusilla) nesting success

ABSTRACT

Altering breeding behavior with age may help birds reduce breeding costs and enhance reproductive success in more experienced breeders. However, agerelated trends appear to be inconsistent, which may be due in part to the logistical difficulties of studying free-ranging populations of identified and known-aged individuals. To further examine how age may influence reproductive behaviors, we examined nest construction, location, and fate in a population of well characterized, known-aged field sparrows (Spizella pusilla). In our population, older parents appeared to have greater overall nest success. Characteristics of the nest itself also influenced whether a nest failed or produced fledglings. These findings suggest that field sparrow breeding success may be influenced by factors attributed to the nest microhabitat and surrounding environment as a whole and also the intrinsic factors attributed to the parents themselves.

INTRODUCTION

- Experience may result in lower reproductive costs and greater breeding success due changes in parental behavior with age (Curio 1983) - Greater offspring provisioning rates (Daunt et al. 2007)
 - Higher-quality food to offspring (Limmer & Becker 2009)
- Age may also influence **nesting characteristics**
 - Access to more favorable territories (Norris et al. 2003)
 - Greater nest concealment (Marzluff 1988)
- Previous studies in birds provide **conflicting and inconsistent results** with respect to the effect of age on breeding behavior/success - Ex: age does not influence field sparrow provisioning rates (Carr et al. *in press*)
- Inconsistent findings may be due to **interactions** between individual, nest, and environmental factors and/or difficulty in monitoring known-aged adult birds
- Banding of our field sparrow population began in Summer 2014 with nearly all birds of known age and identity

QUESTION To what extent do intrinsic (e.g., pair- or nest-specific) and extrinsic (e.g., environmental) factors influence field sparrow nesting success?

PREDICTIONS

- 1. Older pairs have greater reproductive success
- 2. Nests further from edge habitats have greater success due to greater predation risk near forested areas
- 3. Nests in dense vegetation with more coverage are more successful

Selected references

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METHODS

STUDY LOCATION

- Observation period: Summer 2017 present; banding began in 2013
- Chester River Field Research Station, Queen Anne's County, Maryland
- 91.7 ha CRP warm-season grassland (**Fig. 1**)



Figure 1. Chester River Field Research Station in Chestertown, Maryland, a subdivision of Washington College's River and Field Campus. (A) Location within the Mid-Atlantic region and (B) aerial view of the warm season grasslands (Source: GoogleMaps)

BANDING

- Unbanded birds were target-banded with mist nets using audio lures (males) or a flush from the nest (females)
- Birds were assigned a minimum age using molt patterns (Pyle 1997) or by referring to their age when first captured if previously banded
- All adult birds were assigned a combination of three unique color bands to identify individuals using field optics. The color band on the left leg (above the aluminum federal band) indicated sex

NEST SEARCHING & MONITORING

- GPS points were taken for male singing points to map territory boundaries
- Nests were located by observing parental behavior, including agitated "chip" calls, carrying food to offspring, or flushed from the nest
- Nests marked by pink flagging ~1m north of nest
- Monitored every 2-3 days to determine nest fate - *Fail* = predation, mechanical failure,

exposure

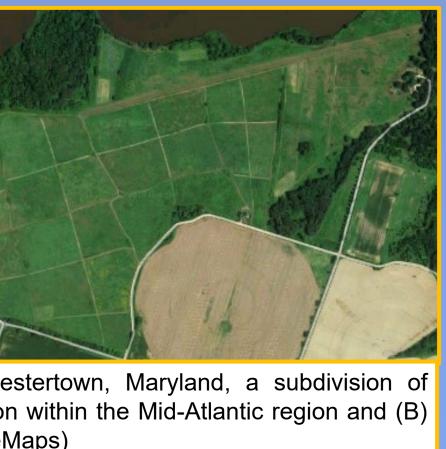
- Success = at least one FISP fledgling
- Chicks banded 6 days post-hatching (PH-6; **Fig. 2**)

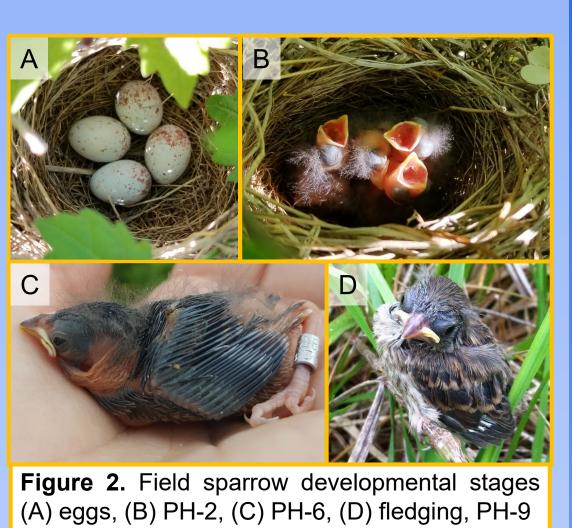
VEGETATION SURVEYS

- **NEST VEG:** Vegetation type and density in 1m² centered around nest - % vegetation type
 - forb, warm-/cool-season grass, bare, duff, woody plants
 - Tallest plant
 - Measure of visual obstruction using Robel pole method
 - Height of pole visible from height of 1m at four cardinal directions 4m away from nest

• NEST CHARACTERISTICS:

- Height of nest
- % nest visible from above
- Distance to woodline or road/path
- **RANDOM VEG:** Same measures as nest vegetation taken at a random direction and distance from nest location





	PRELIMINARY ANALYS								
Number of nests: <i>N</i> ₂₀₁₇ = 97; <i>N</i> ₂₀₁₈ = 91									
Nest outcomes: $N_{\text{fail}} = 125$; $N_{\text{success}} = 63$									
 33% nest success 60% of nest failures attributed to predation 									
 Vegetation at nest location varies considerably from (Table 1) 									
(Table 1)									
	Vegetation criteria		Avg. random	Р					
	Average Robel	57.8 cm	48.3 cm	< 0.001					
	Tallest plant	127.7 cm	117.0 cm	0.002					
	% bare ground	2.3%	5.7%	< 0.001					
	% duff	9.3%	13.4%	< 0.001					
	% cold season grass	0.57%	1.82%	0.024					
	% warm season grass	19.6%	18.7%	0.612					
	% forb	50.0%	45.3%	0.072					
	% woody plant	15.3%	13.2%	0.231					
	% standing dead veg	3.14%	2.09%	0.085					

In the preliminary logistic-exposure model, the following factors (Table 2) significantly influenced nest outcome.

	Log odds	SE	Z	Р	Trends (successful nests)
Sum parent ages	0.076	0.036	2.111	0.035	Older parents
% duff	-0.070	0.025	-2.818	0.005	Less duff
% warm season grass	-0.072	0.024	-2.994	0.003	Less WS grass
% forb	-0.068	0.024	-2.455	0.014	More forbs
% woody plant	-0.051	0.023	-2.210	0.027	More woody veg
Average Robel	0.013	0.005	2.771	0.006	Denser, taller veg

Table 2. Results of a preliminary logistic-exposure model. Only those factors that significantly influenced nest outcome (success/fail) at α = 0.05 are presented here. Trends associated with successful nests are included in the last column.

- method for all five study years (Shaffer 2004)
- success?

- failed nest?

Acknowledgements

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SIS

n surrounding habitat

 Table 1.
 Vegetation
 comparison
 within 1m² centered at the nest and at a corresponding random point for all 188 nests. Average Robel height visible calculated by averaging values at each cardinal direction for each nest. Criteria significant at α = 0.05 after paired *t*-test shown in bold.

FUTURE DIRECTIONS

Continuation and conclusion of project at end of Summer 2021 field season

• Full analysis of factors affecting nest success using logistic-exposure

Consider landscape-level trends in nest outcome

ADDITIONAL QUESTIONS 1. Does a greater distance between active nests reduce predation risk? 2. Does the species of plant where the nest is constructed influence

3. Does dense vegetation enhance success via greater protection from predators, extreme weather, or fluctuations in nest microclimate? 4. Do birds move their nests farther away from the location of a previous

