Effect of Spring Temperature on the Arrival Timing of a Short Distance Migrant, the Field Sparrow (*Spizella pusilla),* at Breeding Grounds in NE Pennsylvania

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INTRODUCTION

There is growing interest in the influence of global climate change on the timing of landbird migration. To date most studies have focused on *en route* timing or, to a lesser extent, timing of arrival at the migratory destination in long-distance migrants. In eastern North America, we define long-distance migrants as those species that winter predominately in Mexico, Central or South America or islands in the Caribbean, whereas short-distance migrants winter predominately in the eastern United States. A number of these long-term studies, though not all, have demonstrated correspondence between earlier capture/arrival dates and increasing spring temperatures (e.g. see Cotton 2003, Marra et al. 2005).

Fewer studies, however, have examined the influence of climate change or yearly variation in environmental conditions on the arrival timing of short-distance migrants (but see Bradley et al. 1999). Because they are likely to have more accurate information regarding temperature conditions at their destination than do long-distance migrants, short-distance migrants are thought to be relatively more flexible in their migratory timing than long-distance migrants and as such, more responsive to environmental conditions both *en route* and at the migratory destination. Using data from a long-term study examining the breeding biology of Field Sparrows (Fig. 1), we examined arrival schedules over a 20 year period (1987-2006) for birds known to have bred at our study site (Fig. 2) in northeastern Pennsylvania. We were interested in evaluating long-term variation in when sparrows arrived at the migratory destination – that is, are birds arriving earlier each year and might this be attributed to global climate change? Further, because Field Sparrows are short-distance migrants wintering in the southeastern United States, we predicted that annual variation in arrival timing would correspond with annual variation in environmental temperatures at the migratory destination.

METHODS

The study site is a series of contiguous old fields in Benton Twp., Lackawanna County, PA, ranging from 6-31 years in age since last human use (Fig. 2). Fields younger than 10 years are characterized by a lush ground cover of grasses and other forbs, primarily goldenrod (*Solidago* spp.) with widely scattered small (typically <1.5 m high) woody vegetation, primarily dogwood (*Cornus* spp.), honeysuckle (*Lonicera* spp.), and rose *(Rosa* spp.). As the fields age, the woody vegetation increases in size and coverage such that fields >20 years old are characterized by dense thickets of woody vegetation with only small scattered areas of open grassy habitat. Field Sparrows prefer breeding in open habitat with some woody vegetation (Carey, et al. 1994). Vegetation analysis of Field Sparrow nest sites in PA indicated that fields ~10 years old offer optimal breeding habitat (Carey, unpub. obs.).

Since 1987, aspects of the breeding biology of a population of Field Sparrows on the study site have been closely followed. Observations were made virtually daily from 1 April to 31 July. Breeding males were considered to have arrived on the site when they were first heard singing there. Individual variation in song allowed individual identification of males, regardless of their banding status. Breeding females were considered to have arrived when they were seen associating with a male on the site. If an unbanded female was seen in daily association with a particular male, that female was considered to be the same individual bird. Only birds that arrived prior to May 31 were used in this analysis. Birds arriving later were considered to have settled elsewhere before moving to the study site.

Temperature data are from the weather station at the Wilkes Barre/Scranton International Airport (~24 km south of the study site at roughly the same elevation) retrieved from the National Climatic Data Center (NCDC). Spearman rank correlations were used in all analyses; significance set at $p < 0.05$.

Figure 1
Field Sparrow (*Spizella pusilla)*

Figure 2
Study site, Benton Twp., Lackawanna County, PA

Figure 3
First male arrival dates and mean April temperatures according to year

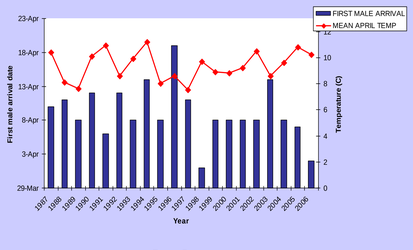

Figure 4
First female arrival dates and mean April temperatures according to year

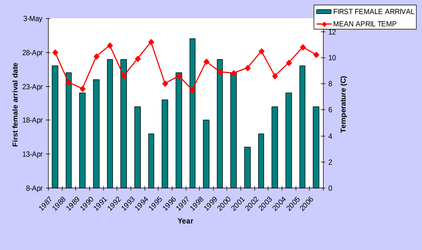

Figure 5
Mean male arrival dates and mean April temperatures according to year

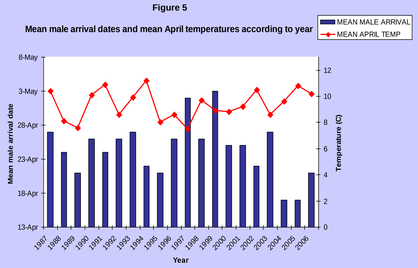

Figure 6
Mean female arrival dates and mean April temperatures according to year

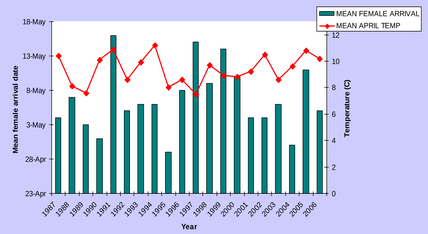

Figure 7
Mean male arrival dates and mean temperature one week prior to arrival date according to year

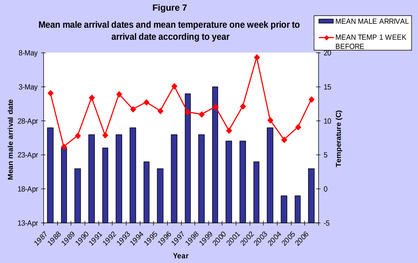

Figure 8
Mean female arrival dates and mean temperatures one week prior to arrival date according to year

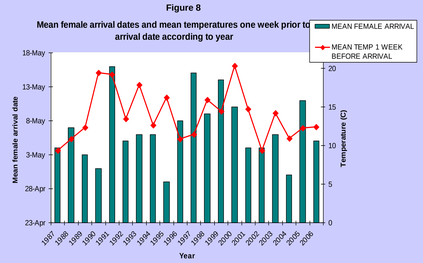

Table 1 – Spearman correlation analyses of arrival dates with temperatures (df = 18 in all)

Variables	Spearman R	p
Earliest -mean April temp (Fig. 3)	-0.31	0.18
Earliest -mean April temp (Fig. 4)	-0.25	0.28
Mean -mean April temp (Fig. 5)	-0.22	0.35
Mean -Mean April temp (Fig. 6)	0.06	0.77
Mean -mean temp 1 week prior (Fig. 7)	0.31	0.18
Mean -mean temp 1 week prior (Fig. 8)	0.33	0.15
Mean -mean temp 2 weeks prior	0.14	0.54
Mean -mean temp 2 weeks prior	0.18	0.45

RESULTS AND DISCUSSION

Figs. 3 – 8 summarize data on yearly arrival dates for breeding males and females on the study site and also present annual mean temperature data for portions of the migration period.

Focusing on the mean April temperature lines in Figs. 3 or 4, there is no significant trend toward increasing temperature with year ($R = 0.16$, $p = 0.50$). Similarly, there is no significant trend toward earlier mean male arrival with year ($R = -0.27$, $p = 0.26$) or earlier mean female arrival with year ($R = 0.10$, $p = 0.68$).

There is, however, annual variation in male and female arrival. Dates for first individual arrivals of the year are in Figs. 3 and 4. Mean arrival date for the earliest individual male over all years was 9 April (range 1 April – 19 April); mean arrival date for the earliest individual female was 23 April (range 14 April – 30 April). There was no significant correlation between first male and first female arrival dates ($R = 0.12$, $p = 0.62$)

Mean arrival dates for all breeding males and females in a year are in Figs. 5-8. Over all years mean male arrival date was 24 April (range 17 April – 3 May); mean female arrival was 7 May (range 29 April – 16 May). There was no significant correlation between mean male and mean female arrival dates ($R = 0.37$, $p = 0.11$)

In no instance was there the expected correlation between increased spring temperatures in a year and earlier arrival dates of either male or female field Sparrows (see Table 1). It appears, then, that factors other than spring temperatures are the primary regulators of migratory arrival in this population.

Regulating timing strictly by photoperiod cues is often cited as a possible reason for a lack of correlation between temperature and migration timing. However, if migration timing was being affected strictly by photoperiod, we would expect yearly arrivals to be relatively invariant in time; certainly not the case in this population.

A confounding factor in this analysis might be the relatively rapid successional changes occurring in this old-field habitat. Habitat quality appears to decline as fields age beyond 10 yrs since last human usage. Assuming that sparrows will settle earlier on higher quality territories, our arrival data may be affected by successional quality changes. As seen in Fig. 2, however, fields on the site vary in successional age, and we find no significant relationship between field age and arrival time.

In conclusion, we do not know what factor(s) regulate arrival timing in this population. We would welcome any suggestions.

REFERENCES

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