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Winter habitat of the Smith's Longspur in Oklahoma

BY CHERYL G. ORMSTON

The Smith's Longspur *(Calcarius pictus)* winters primarily in the southern Great Plains and breeds in the arctic (Briskie 1993). Inhabiting grasslands and prairies and often nomadic on the wintering range, the species is difficult to observe and study, and consequently little is known about winter flock composition and site fidelity (Dunn and Dunn 1999). We lack basic information on the winter ecology of the Smith's Longspur, and this has complicated efforts to formulate conservation and management plans for the nonbreeding season (Briskie 1993). The objective of my study was to determine what habitat characteristics are preferred by Smith's Longspurs in Oklahoma in winter.

MATERIALS AND METHODS

I selected study sites based on data provided by J. Hoffman (pers. comm). Based on censuses taken by Hoffman in the winter of 1998–1999, I chose 14 representative sites in northeastern Oklahoma (Table 1) where Smith's Longspurs were known to occur. My measure of longspur use of a site was the maximum single-day count of Smith's Longspurs by Hoffman in the winter of 1998–1999. Most of the study sites were used as hay fields, although cattle had grazed two fields and one was a park area for a subdivision. Each site had a source of water on or near the premises, most often ponds and creeks. Presence or absence of grazing activity by livestock was noted for each site.

I sampled vegetation from early January 1999 through mid March 1999. I used 30 sampling plots at each field. I randomly determined the position of each sample by assigning numbers to the four corners of a field and using a random number table to determine which corner to start from. I used a random numbers table to select compass points at 30-de-

Table 1. Sites containing Smith's Longspurs for which vegetation was sampled, 1998–1999, in northeastern Oklahoma.

Field	Size (ha)	County	Field use	Nearest town
1	19.5	Nowata	grazing	Bartlesville
2	17.8	Tulsa	no cattle	Mounds
3	26.6	Washington	no cattle	Bartlesville
4	22.0	Tulsa	haying	Skiatook
5	9.0	Tulsa	park area	Broken Arrow
6	13.9	Noble	haying	Red Rock
7	19.1	Osage	haying	Pawhuska
8	19.8	Osage	no cattle	Foraker
9	25.3	Tulsa	grazing	Skiatook
10	21.4	Osage	haying	Grainola
11	22.8	Creek	haying	Mannford
12	17.7	Mayes	no cattle	Adair
13	19.9	Mayes	no cattle	Foyil
14	20.2	Osage	no cattle	Foraker

gree intervals and the direction to move for each sequential sample. The distance between each sample was determined by relative field size so as to insure representative coverage throughout the field. For each sample, I delineated a plot area of 0.5 m X 2.0 m (1 $^{m}2$) by placing rectangularly-shaped conduit frame on the ground. This represented a modified-Whittaker plot that minimizes statistical problems of the Whittaker and Long-Thin designs (Stohlgren et al. 1995). I identified each species present inside the plot and measured the height of the tallest plant of each species. Through a visual estimation, a percentage cover for each species was assigned. The estimations were made in accordance with the system used in the Braun-Blanquet's cover-abundance scale that allows the estimation of both the percentage of area covered by a species and its abundance (Kuchler 1967).

I expressed plant diversity with the Simpson's Index. This index measures the probability that any two individuals drawn at random will be the same (Simpson 1949). This index was selected as opposed to other diversity indices because of its low sensitivity to sample size (Magurran 1988). To improve diversity estimates, for each site I used a jack-knife technique that repeatedly recalculated the diversity index, leaving one sample out of the 30 each time. Each calculation produces a jack-knife

Table 2. Mean (± SE_{est}) percent coverage of each plant species and the percentage of fields at which each species was found. Species were identified in accordance with Pohl (1978). Each unidentified plant type ("unknown") represented 5% or less coverage.

Species	Mean	SE	% of fields
Bouteloua curtipendula	0.56	0.94	64
B. gracilis	1.57	3.67	21
Aster	0.70	2.12	29
Panicum virgatum	0.58	1.05	36
Panicum spp.	1.00	1.46	79
Sporobolus	12.03	15.82	93
Cynodon dactylon	6.33	17.27	43
Andropogon virginicus	9.39	17.34	57
Andropogon spp.	0.62	1.45	36
Schizachyrium scoparium	18.42	18.48	79
Setaria	2.55	3.68	93
Senecio	0.55	1.06	64
Aristida oligantha	3.42	4.31	57
Aristida spp.	2.93	10.05	43
Sorghastrum nutans	1.36	1.60	57
Ambrosia	3.40	5.44	64
Taraxacum	0.05	0.07	43
Paspalum	0.20	0.23	57
Hieracium longipilum	0.04	0.07	36
Achillea millefolium	0.06	0.10	36
Eragrostis	0.32	0.88	43
moss	0.17	0.26	43
Gutierrezia	0.38	1.21	14
Rubus	0.14	0.36	21
Buchloe dactyloides	0.19	0.62	14
Chaerophyllum tainturieri	0.08	0.18	21
Sorghum halepense	0.02	0.06	14
unknown	27.26	22.03	86
bare ground	2.36	2.75	71

estimate which is used to obtain a jack-knife pseudovalue (Magurran 1988). This method treats each transect as a sample and uses the diversity values from all samples to arrive at an estimate of diversity for a site (Smith and van Belle 1984). To determine which habitat features were significantly related to the number of birds at a site, I performed a backwards-stepwise multivariate linear regression using the maximum number of longspurs counted at the site as the dependent variable and field characteristics as independent variables. Plant species chosen for inclusion in the regression analysis were ones that tended to occur at most sites or were otherwise suspected to influence longspur use of a site. I used a sequential Bonferroni correction (Rice 1989) to correct significance levels for the likelihood that a large number of tests would produce some significant results simply by chance.

RESULTS

The plant species most common on the study sites (see Table 2) were little bluestem *(Schizachyrium scoparius*; 18.42%), dropseed *(Sporobolus* spp.; 12.03%), broomsedge bluestem *(Andropogon virginicus*; 9.39%), three-awn *(Aristida* spp.; 6.35%), and Bermuda grass *(Cynodon dactylon*; 6.33%). The mean (± SE) Simpson's index of plant diversity for the fields (N = 14) with Smith's Longspurs was 6.65 (± 4.16). The mean (± SE) height of the vegetation in the fields was 49.47 (± 4.41) cm.

The results of the multiple regression (Table 3) revealed significant associations between the maximum number of birds and the percent coverage of moss ($P < 0.0309$) and panic grass *(Panicum)* species ($P < 0.0013$). A sequential Bonferroni test, however, revealed that only the latter held significance at a table-wide level. Size of the field, plant species diversity, and extent of coverage by most of the more common plants had no effect on relative use of a site by Smith's Longspurs.

DISCUSSION

Smith's Longspurs in Oklahoma seem to occur in areas of relatively low plant species diversity, which is characteristic of most grassland birds in the Great Plains (Zimmerman 1992). Work by Grzybowski (1982) determined that Smith's Longspurs predominantly used heavily grazed areas of three-awn *(Aristida)* species (plant height less than 0.5 m). He also found that grassland bird abundance in general was positively related to abundance of food, which for most of the birds was seed. Bird densities increased on heavily grazed fields because grasses with high seed production were more abundant there (Grzybowski 1982).

My study also indicated that Smith's Longspurs associate with moderately to heavily grazed fields. The mean height of 49.47 cm found here falls into Grzybowski's heavily grazed category, near the threshold of moderately grazed. This height may give the birds enough cover from

Table 3. Results of multiple linear regression for number of Smith's Longspurs counted at a site in relation to habitat variables. Effect that was significant after sequential Bonferroni correction is shown in boldface.

Variable	Regression coefficient	P
Andropogon virginicus	− 0.18903	0.98
Sporobolus	− 0.05932	0.97
field size	0.04851	0.94
diversity index	− 8.18331	0.43
Bouteloua curtipendula	14.42273	0.55
vegetation height	− 3.88730	0.45
Schizachyrium scoparium	0.85296	0.50
Setaria	− 8.80087	0.27
Aristida	3.57449	0.058
moss	180.13793	0.031
Panicum	38.33936	**0.001**

predators such as the Northern Harrier *(Circus cyaneus)* and coyote *(Canus latrans*; Dunn and Dunn 1999).

In selecting a winter habitat, Smith's Longspurs may cue on the presence of *Panicum*, as I found that longspur numbers tended to increase with the abundance of these plants. Because seeds from *Panicum* make up some of the winter diet of the Smith's Longspur (Briskie 1993), finding more birds in fields containing these species is not surprising. Similarly, both dropseed *(Sporobolus)* and three-awn *(Aristida)*, seeds of which are known to be included in the Smith's Longspur winter diet (Briskie 1993), were common in fields used by the birds. The birds appear to associate with sites able to support their preferred winter food.

Another cue for habitat choice could be the presence of moss or a related variable like wetness. Although the Bonferroni test removed the significance of moss in the multiple regression, it may still be of importance to the birds. Smith's Longspurs have been observed to associate with wet or marshy areas (Kemsies 1968). The presence of moss could

reflect damp conditions that promote growth of plant species preferred by the birds.

Based on the results of this study, Smith's Longspurs in winter could best be managed by maintaining tracts of land that support *Panicum* in addition possibly to *Sporobolus* and *Aristida*. As the birds' winter diet contains these species, the presence of these plants seems important. Preferred habitat seems to be moderately to heavily grazed hay fields. Studies of the Chestnut-collared Longspur *(Calcarius ornatus)* on its breeding grounds indicate that this bird also associates with grazed hay pastures containing native grasses (Johnson et al. 1998). Chestnut-collared Longspurs prefer vegetation height < 20–30 cm, but extreme overgrazing can lead to lower densities of birds. Management recommendations for Chestnut-collared Longspurs included protecting open, grazed native prairie and avoiding accumulations of dense vegetation litter. Burning and annual mowing are beneficial to Chestnut-collared Longspurs, as is grazing at moderate to heavy levels (Johnson et al 1998). The same would seem to hold true for Smith's Longspurs in Oklahoma in winter.

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