Abundance and Habitat Associations of Winter and Spring Birds on a Reclaimed Surface Mine (The Wilds) in Ohio, USA

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ABSTRACT. Several studies have examined how grassland birds use reclaimed surface mines during the breeding season, but few studies have documented how these birds use these areas during the winter and early spring months. Using point counts, birds occupying a reclaimed surface-mine site in southeastern Ohio were surveyed from late December 2020 to April 2021. The primary objective was to document bird abundance and species richness across a temporal gradient spanning from late December 2020 through April 2021. Additionally, bird species composition was examined in habitat patches dominated by cool-season plants and in a single warm-season plot dominated by switchgrass (*Panicum virgatum*). A total of 1,452 bird sightings were made consisting of 40 species in 7 orders. Songbirds (order Passeriformes) comprised 60% of all sightings, and most of these (53%) were Red-winged Blackbirds (*Agelaius phoeniceus*), Eastern Meadowlarks (*Sturnella magna*), and Song Sparrows (*Melospiza melodia*). Thirty-nine species were observed on cool-season sites versus 13 species in the switchgrass plot. Species including returning Eastern Meadowlarks, Henslow's Sparrows (*Centronyx henslowii*), and Field Sparrows (*Spizella pusilla*) were common on the cool-season plots, but uncommon or absent in the switchgrass plot. Conversely, the switchgrass plot had more wintering American Tree Sparrows (*Spizelloides arborea*) and returning Swamp Sparrows (*Melospiza georgiana*). Return rates of long-distance migratory species fell within the time frames for these species as obtained from previous studies in this region. The diverse habitat structure of the cool-season portions of this study site attracted some winter species, including birds of prey, as well as several returning migratory species.

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INTRODUCTION

During the past 50 years, the decline of grassland bird species is occurring at a higher rate than for birds of any other North American biome (Sauer et al. 2017; Rosenberg et al. 2019). Reclaimed surface mines provide suitable nesting habitat for several obligate grassland bird species in the Appalachian Region of the eastern United States (Bajema et al. 2001; Monroe and Ritchison 2005; Galligan et al. 2006; Ingold et al. 2010; Ingold and Dooley 2013). To date however, few published studies have examined the use of reclaimed surface mines by birds during the winter and early spring months. The abundance and foraging behavior of winter birds of prey on reclaimed surface mines have been studied (Vukovich and Ritchison 2008; Ingold 2010; Slankard et al. 2018), as well as the winter habitat use by Northern Bobwhites (*Colinus virginianus*) (Unger et al. 2015). Conversely, no studies were identified that focused on the use of reclaimed surface mines by winter passerine species. In addition, no studies were found reporting the return dates of migrating passerine species to their breeding areas on reclaimed surface mines.

Most obligate grassland passerine birds (order Passeriformes) that nest on reclaimed surface mines in North America, including Henslow's Sparrows (*Centronyx henslowii*), Grasshopper Sparrows (*Ammodramus savannarum*), Savannah Sparrows (*Passerculus sandwichensis*), and Bobolinks (*Dolichonyx oryzivorus*), are long-distance migrants (Herkert et al. 2020; Renfrew et al. 2020; Vickery 2020; Wheelwright and Rising 2020). Others such as Horned Larks (*Eremophila alpestris*) and Eastern Meadowlarks (*Sturnella magna*), as well as some generalist grassland-shrubland species such as Field Sparrows (*Spizella pusilla*), Song Sparrows (*Melospiza melodia*), and Red-winged Blackbirds (*Agelaius phoeniceus*), are less inclined to migrate long distances and may be found year-round in the

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same area (Arcese et al. 2020; Beason 2020; Carey et al. 2020; Jaster et al. 2020; Yasukawa and Searcy 2020). Finally, some migratory passerine species —including American Tree Sparrows (*Spizelloides arborea*), Snow Buntings (*Plectrophenax nivalis*), Lapland Longspurs (*Calcarius lapponicus*), and Northern Shrikes (*Lanius borealis*) that all nest in northern boreal forests or on the arctic tundra— overwinter in these grassland habitats (Hussell and Montgomerie 2020; Montgomerie and Lyon 2020; Naugler et al. 2020; Paruk et al. 2020).

Return dates of long-distance migrants that nest on reclaimed surface mines in Ohio vary among species. For example, Eastern Meadowlarks in this region may initiate nesting as early as late March (Jaster et al. 2020) whereas Henslow's Sparrows and Grasshopper Sparrows begin nesting in late April to early May (Herkert et al. 2020; Vickery 2020). The onset of nesting for Bobolinks in this region is generally early to mid-May (Renfrew et al. 2020). With slowly but steadily increasing global temperatures (Hegerl et al. 2007; Räisänen and Ruokolainen 2008), there is evidence that some short- and mid-distance migratory birds have been arriving on their breeding grounds earlier in the spring in recent decades (Butler 2003; Inkley et al. 2004; Marra et al. 2005; Mills 2005; Miller-Rushing et al. 2008; Swanson and Palmer 2009). Eight years of point-count data collected during the early portion of the breeding season, prior to the current study, indicates grassland bird species were arriving sooner on this reclaimed area (Ingold and Dooley, unpublished data). Conducting bird surveys prior to the traditionally anticipated arrival of short- and long-distance migrants is warranted to confirm this trend.

Numerous studies have shown that native warm-season plant species can be beneficial to breeding grassland birds (Walk and Warner 2000; Giuliano and Daves 2002; Murray and Best 2003; Bakker and Higgins 2009; Jaster et al. 2014), although little if any work has examined the use of warm-season grasses by birds during the winter. Most reclaimed surface mines are dominated by non-native cool-season plant species (Bajema et al. 2001; Monroe and Ritchison 2005; Galligan et al. 2006; Stauffer et al. 2011). Grassland restoration efforts on this study site have included establishing limited patches of warm-season native prairie grasses dominated by switchgrass (*Panicum virgatum*) and big bluestem (*Andropogon gerardii*) (personal observation). The objectives of this research were threefold: (1) estimate abundances of winter, year-round resident, and spring resident birds on a reclaimed surface mine; (2) compare winter and spring bird species composition in habitat patches dominated by mostly cool-season plant species versus a single contiguous warm-season habitat patch dominated by switchgrass; and (3) examine temporal patterns and approximate arrival times of the most common winter resident and returning migratory grassland species.

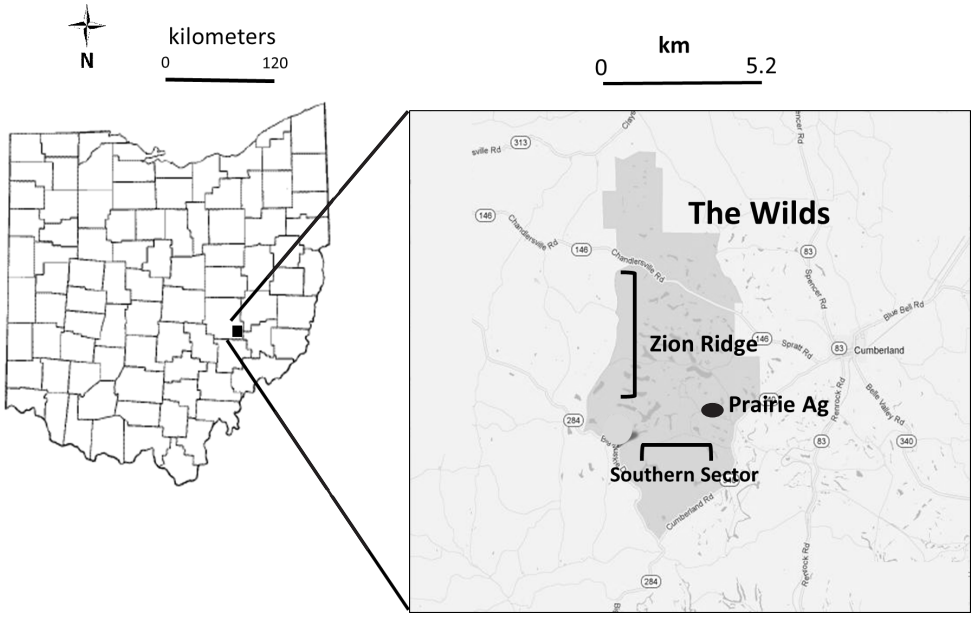

FIGURE 1. The 3,700-hectare study area (shaded area within box, right) is located at the intersection of Muskingum, Guernsey, and Noble Counties, Ohio. The Zion Ridge sector (17 count sites) was reclaimed in 1974 to 1979, while the southern sector (13 count sites) was reclaimed in 1981 to 1984. The Prairie Agricultural warm-season sector (9 count sites) was established in May 2011.

STUDY AREA AND METHODS

The Wilds® is a conservation education and research center located on 3,700 hectares of land—largely a reclaimed surface mine—located in portions of Muskingum, Guernsey, and Noble Counties in southeastern Ohio (Fig. 1). The property was initially surface mined by the Central Ohio Coal Company in the 1940s and 1950s. From 1969 to 1984 it was mined a second time, with mining proceeding from north to south and reclamation efforts occurring each year after mining was completed (Dooley and Murray 2006). Seed mixes used during initial reclamation were comprised largely of cool-season species including fescue (*Festuca* sp.), orchard grass (*Dactylis glomerata*), smooth bromegrass (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), timothy grass (*Phleum pratense*), ryegrass (*Lolium* sp.), redtop (*Agrostis gigantea*), bird's-foot trefoil (*Lotus corniculatus*), alfalfa (*Medicago sativa*), and sericea lespedeza (*Lespedeza cuneata*) (Ingold 2002; Dooley and Murray 2006).

One of 2 sites dominated by cool-season plant species in this study is located along Zion Ridge Road (Zion Ridge – ZR) which makes up the western boundary of The Wilds (Fig. 1). This site is about 5.5 km in length, extending north to south. The second cool-season site is an approximate 200 ha circular plot located in the southern portion of The Wilds (Southern Sector – SS) (Fig. 1). Subsequent to reclamation efforts in 1985, a variety of opportunistic forbs that thrive in disturbed areas encroached on portions of both the ZR and SS sites. These include thistle (*Cirsium* sp.), goldenrod (*Solidago* sp.), yellow sweetclover (*Melilotus officinalis*), teasel (*Dipsacus fullonum*), milkweeds (*Asclepias* sp.), and Indian hemp (*Apocynum cannabinum*). In addition, during the past 20 years there has been a slow but steady encroachment of woody shrubs: autumn olive (*Elaeagnus umbellata*) along ZR and both autumn olive and Amur honeysuckle (*Lonicera maackii*) in portions of the SS. Portions of both the ZR and SS sites include a variety of scattered tree species including black locusts (*Robinia pseudoacacia*), honey locusts (*Gleditsia triacanthos*), black willows (*Salix nigra*), and common cottonwoods (*Populus deltoides*). This mixed plant community provides potential habitat for a variety of scrubland/savannah bird species (DeVault et al. 2002). Finally, an approximately 5.5 ha lake—the location of 3 point-count stations—ran parallel to a portion of the ZR site.

On at least 3 occasions from 2013 to 2017, small portions of the ZR and SS sites (approximately 20% and 5% respectively) were tilled and planted with a warm-season mix including switchgrass, big bluestem, eastern gamagrass (*Tripsacum dactyloides*), Canada wildrye (*Elymus canadensis*), Maximillian sunflower (*Helianthus maximiliani*), purple coneflower (*Echinacea purpurea*), and grayhead prairieconeflower (*Ratibida pinnata*). These areas (approximately 30 ha total) have been left relatively unmanaged and, to varying degrees, have become mixed with cool-season forbs and grasses. In 2013, to census breeding birds on these sites, 17 point-count stations were established (Ingold and Dooley, unpublished) along ZR and 24 stations in the SS. The minimum distance between any 2 points on either of these sites is 160 m.

In May 2011, a contiguous, warm-season 24 ha plot, the Prairie Agricultural Sector (PA), was established inside The Wilds perimeter (Fig. 1). Land preparation for this site was extensive, and the warm-season species that were planted (same as above) became well established in the first few years. Management of this section has included at least 2 burns, the latest occurring in February 2017. Unlike any of the other warm-season plantings that occurred on the ZR and SS sites, this plot came to be dominated by tall, densely vegetated switchgrass—particularly in the past few years. Much of this switchgrass was dead and represented an accumulation of growth from previous years. Thus, the PA sector is structurally and compositionally distinct from the ZR and SS sites. Ingold and Dooley (unpublished) established 8 point-count stations in 2015, and a ninth in 2021, to monitor breeding birds at the PA site. All 9 of the PA point count stations are at least 160 m apart.

From 22 December 2020 through 28 April 2021, visual/vocal point counts were conducted, 2 to 4 times monthly, at each of the 17 ZR stations and each of the 8 PA stations (including the ninth in February 2021). Several of the 24 stations in the SS were difficult to access by foot during the winter, so a subset of 13 of the more accessible points were monitored. All counts were conducted between 0700 and 1030 h on days with no rain and wind speeds generally less than 32 km/h (20 mi/h). Surveys were conducted following the protocol which was modified from the Breeding

Bird Survey technique (Ralph et al. 1995). This method involved undertaking a 6-minute point count, at the center of an 80-meter-radius circle, at each station. The species and sex (when possible) of all birds detected by sight or sound within this 80-meter-radius circle were recorded. Birds that flew into the circle and landed during the count were also included; however, birds that flew into the plot—but did not land—were not counted (with the exception of birds of prey (which often do not land) and Trumpeter Swans, *Cygnus buccinator*). The approximate return week of mid- and long-distance migratory songbirds to this study site were recorded. A 2×5 contingency table χ^2 test (2 habitats, 5 months) was performed to determine if there was a difference in the frequency of birds/visit to the cool vs. warm-season plots across months. Linear regression analysis was used (Excel version 1808) to determine if there was a relationship between the numbers of a given species observed (dependent variable) and the progression of time as measured in weeks (independent variable) beginning from late December through April.

RESULTS

A total of 40 species of birds were detected among 1,452 observations made from December 2020 through April 2021 (Table 1). Of the 7 orders represented, 60% were songbirds (order Passeriformes)—the most common of which were Red-winged Blackbirds, Eastern Meadowlarks, and Song Sparrows, which combined comprised 53% of all sightings. Short-eared Owls (*Asio flammeus*) and Northern Harriers (*Circus hudsonius*) were the most abundant birds of prey (approximately 4% collectively) while Trumpeter Swans (*Cygnus buccinator*) were the most common waterfowl species (1%). Four Northern Shrikes, a long-distance winter migrant, were observed in patches of trees in February and early March in one of the cool-season grassland plots.

A total of 39 bird species were observed in the cool-season mixed grass/shrub habitats (ZR and SS) and 13 species in the warm-season plot dominated by switchgrass. Twenty-seven of the 40 total species were observed only in the cool-season plots (67.5%) (Table 1). Red-winged

Table 1

Total number of species observations, percent of total, and the total number of each species per point visit on cool-season plots (417 total point visits to 30 points) and on the single warm-season switchgrass plot (112 total point visits to 9 points) from 22 December 2020 through 28 April 2021

Species	Number of observations		Percent of total		Birds/visit [a]	
	Cool	Warm	Cool	Warm	Cool	Warm
Red-winged Blackbird (*Agelaius phoeniceus*)	265	95	24.5	35.2	0.64	0.84
Eastern Meadowlark (*Sturnella magna*)	223	18	20.6	6.7	0.53	0.16
Song Sparrow (*Melospiza melodia*)	129	35	11.9	12.9	0.31	0.31
American Robin (*Turdus migratorius*)	103	3	9.5	1.1	0.25	0.03
American Tree Sparrow (*Spizelloides arborea*)	56	36	5.2	13.3	0.13	0.32
Swamp Sparrow (*Melospiza georgiana*)	23	63	2.1	23.3	0.05	0.56
Henslow's Sparrow (*Centronyx henslowii*)	73	4	6.7	1.5	0.18	0.04
Field Sparrow (*Spizella pusilla*)	71	2	6.5	0.7	0.17	0.02
Eastern Towhee (*Pipilo erythrophthalmus*)	33	-	3.0	-	0.08	-
Short-eared Owl (*Asio flammeus*)	25	-	2.3	-	0.06	-
Northern Harrier (*Circus hudsonius*)	15	9	1.3	3.3	0.03	0.08
American Goldfinch (*Spinus tristis*)	21	-	1.9	-	0.05	-

[a] Data were conformed to birds/visit to account for unequal numbers of visits to some point stations during the study.

Table 1 (continued)
Total number of species observations, percent of total, and the total number of each species per point visit on cool-season plots (417 total point visits to 30 points) and on the single warm-season switchgrass plot (112 total point visits to 9 points) from 22 December 2020 through 28 April 2021

Species	Number of observations		Percent of total		Birds/visit [a]	
	Cool	Warm	Cool	Warm	Cool	Warm
Trumpeter Swan (*Cygnus buccinator*)	16	-	1.5	-	0.04	-
Eastern Bluebird (*Sialia sialis*)	15	-	1.3	-	0.03	-
Northern Mockingbird (*Mimus polyglottos*)	14	-	1.2	-	0.03	-
Brown Thrasher (*Toxostoma rufum*)	12	-	0.8	-	0.02	-
Common Yellowthroat (*Geothlypis trichas*)	11	-	0.7	-	0.02	-
Northern Flicker (*Colaptes auratus*)	8	-	0.5	-	0.01	-
Blue Jay (*Cyanocitta cristata*)	8	-	0.5	-	0.01	-
Tree Swallow (*Tachycineta bicolor*)	8	-	0.5	-	0.01	-
Mallard (*Anas platyrhynchos*)	7	2	0.4	0.7	0.01	0.02
Hooded Merganser (*Lophodytes cucullatus*)	6	-	0.4	-	0.01	-
Red-tailed Hawk (*Buteo jamaicensis*)	6	-	0.4	-	0.01	-
American Kestrel (*Falco sparverius*)	5	1	0.3	0.4	0.009	0.01
Northern Cardinal (*Cardinalis cardinalis*)	5	-	0.3	-	0.009	-
Northern Shrike (*Lanius borealis*)	4	-	0.2	-	0.007	-
Killdeer (*Charadrius vociferus*)	4	-	0.2	-	0.007	-
Osprey (*Pandion haliaetus*)	3	1	0.2	0.4	0.005	0.01
Rough-legged Hawk (*Buteo lagopus*)	2	-	0.1	-	0.004	-
Carolina Chickadee (*Poecile carolinensis*)	2	-	0.1	-	0.004	-
Carolina Wren (*Thryothorus ludovicianus*)	2	-	0.1	-	0.004	-
Wood Duck (*Aix sponsa*)	2	-	0.1	-	0.004	-
Canada Goose (*Branta canadensis*)	2	-	0.1	-	0.004	-
Yellow Warbler (*Setophaga petechia*)	2	-	0.1	-	0.004	-
Red-shouldered Hawk (*Buteo lineatus*)	1	-	0.06	-	0.001	-
Red-bellied Woodpecker (*Melanerpes carolinus*)	-	1	-	0.4	-	0.01
Brown-headed Cowbird (*Molothrus ater*)	1	-	0.06	-	0.001	-
Common Grackle (*Quiscalus quiscula*)	1	-	0.06	-	0.001	-
Grasshopper Sparrow (*Ammodramus savannarum*)	1	-	0.06	-	0.001	-
Barn Owl (*Tyto alba*)	1	-	0.06	-	0.001	-

[a] Data were conformed to birds/visit to account for unequal numbers of visits to some point stations during the study.

Blackbirds were the most common species in both the cool-season plots (25%) and the warm-season switchgrass plot (35%), and Song Sparrows were also common in both habitat types (Table 1). Several species including Eastern Meadowlarks, American Robins (*Turdus migratorius*), Henslow's Sparrows, and Field Sparrows were prevalent in the cool-season grassland plots but less common in the warm-season switchgrass plot (Fig. 2). Conversely, the warm-season switchgrass plot had a higher percentage of Swamp Sparrows (*Melospiza georgiana*) and American Tree Sparrows than did the cool-season plots (Fig. 2).

The mean number of bird observations per visit was notably, although not significantly, higher ($\chi^2 = 4.37$, df = 4, $p > 0.05$) in the warm-season switchgrass plot during the winter months—with a shift to the cool-season plots during the late winter and early spring months (Fig. 3). The number of American Tree Sparrow and Song Sparrow observations both declined significantly from December to April on the warm-season switchgrass plot (F = 17.6, $p < 0.001$, df = 12; F = 6.8, $p < 0.02$, df = 12, respectively) (Fig. 4). Conversely, no trend was detected with American Tree Sparrows and time on the cool-season plots (F = 3.2, $p > 0.05$, df = 17), although numbers of Song Sparrow observations increased significantly from December to April (F = 7.9, $p < 0.01$, df = 17) (Fig. 5). A few Red-winged Blackbirds and Eastern Meadowlarks were observed on one or both study sites in late February; however, their numbers increased significantly with the progression of time on both the cool-season plots (F = 34.2, $p < 0.001$, df = 17; F = 35.6, $p < 0.001$, df = 17, respectively) (Fig. 5) and the warm-season switchgrass plot (F = 47.1, $p < 0.001$, df = 12; F = 14.4, $p < 0.01$, df = 12, respectively) (Fig. 4). Field Sparrows began arriving back during the fourth week of March, while Henslow's Sparrows began their arrival during the first week of April (Table 2). Although numbers of both Field Sparrows and Henslow's Sparrows were minimal on the warm-season plot (2 and 4 individuals respectively), their numbers increased significantly from December to April on the cool-season plots (F = 17.5, $p < 0.001$, df = 17; F = 14.7, $p < 0.001$, df = 17, respectively) (Fig. 5). While a few Swamp Sparrows were observed on the warm-season plot in January, their numbers increased significantly beginning in late March on both the cool-season plots and the warm-season plot (F = 8.1, $p < 0.01$, df = 17; F = 13.1, $p < 0.01$, df = 12, respectively). Eastern Towhees (*Pipilo erythrophthalmus*) arrived back on the cool-season sites during the second week of March, while Common Yellowthroats (*Geothlypis trichas*) and Yellow Warblers (*Setophaga petechia*) arrived back during the fourth week of April (Table 2). The first Grasshopper Sparrows and Bobolinks of the year were also observed during the fourth week of April on the cool-season plots only (Bobolinks were not observed during actual point counts) (Table 2).

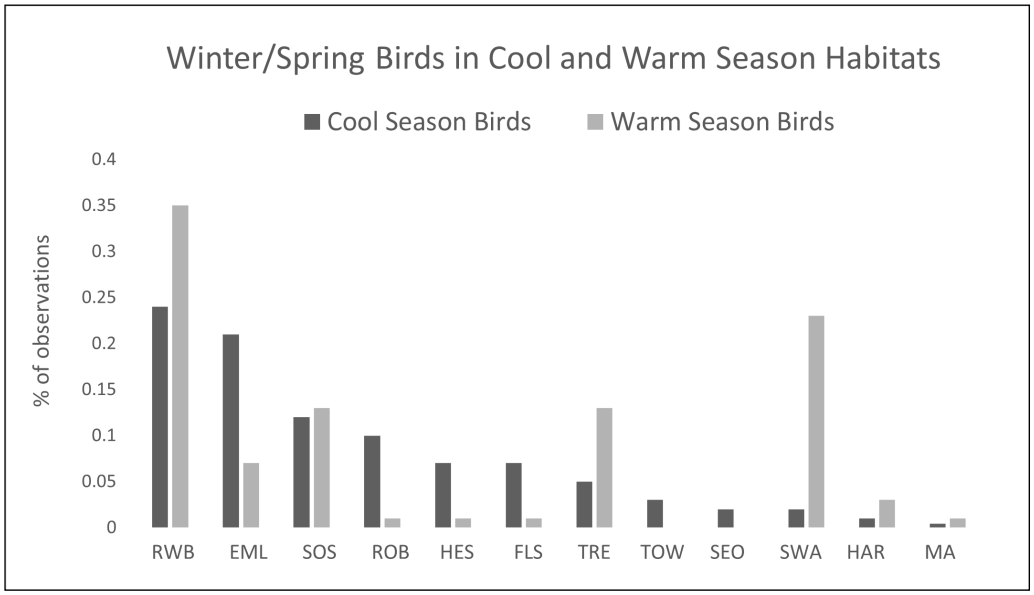

FIGURE 2. Percent of bird species detected in each habitat category (cool-season vs. warm-season switchgrass) from 22 December 2020 through 28 April 2021. RWB = Red-winged Blackbird, EML = Eastern Meadowlark, SOS = Song Sparrow, ROB = American Robin, HES = Henslow's Sparrow, FLS = Field Sparrow, TRE = American Tree Sparrow, TOW = Eastern Towhee, SEO = Short-eared Owl, SWA = Swamp Sparrow, HAR = Northern Harrier, and MA = Mallard.

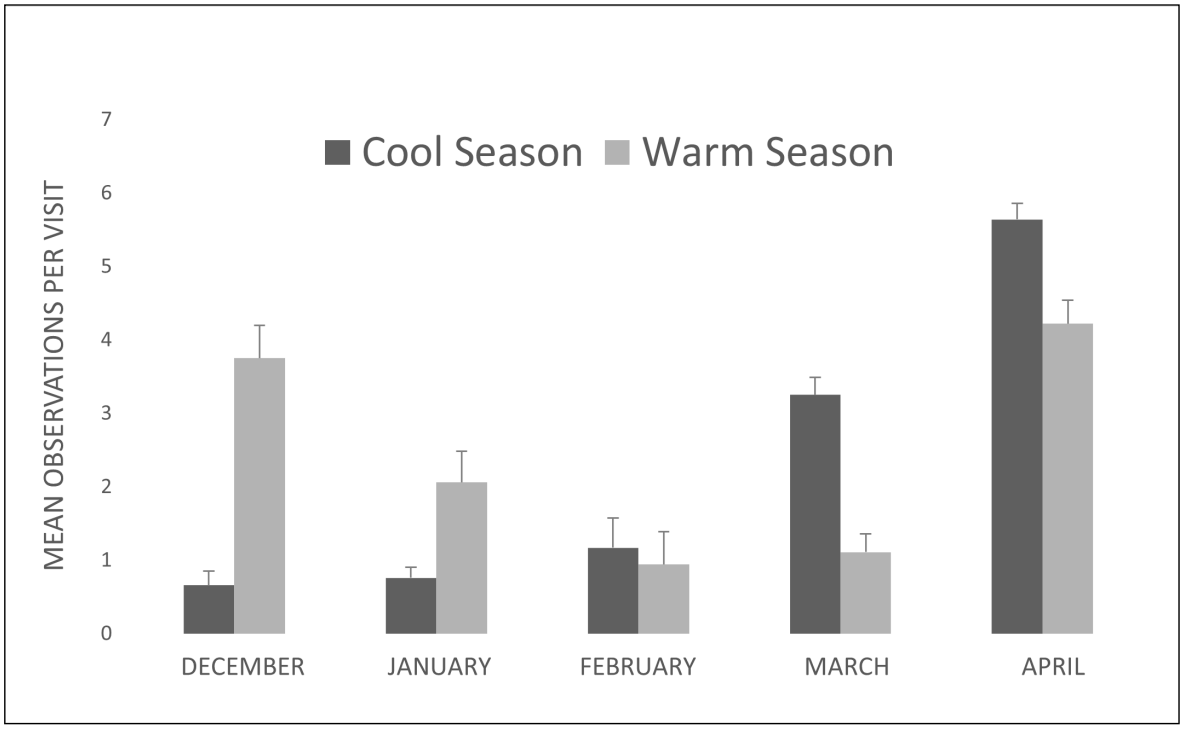

FIGURE 3. Mean number of bird observations per visit in cool-season plots (417 total point visits; 1,182 total sightings) vs. warm-season switchgrass plot (112 total point visits; 270 total sightings) from 22 December 2020 through 28 April 2021. Bar extensions represent standard errors.

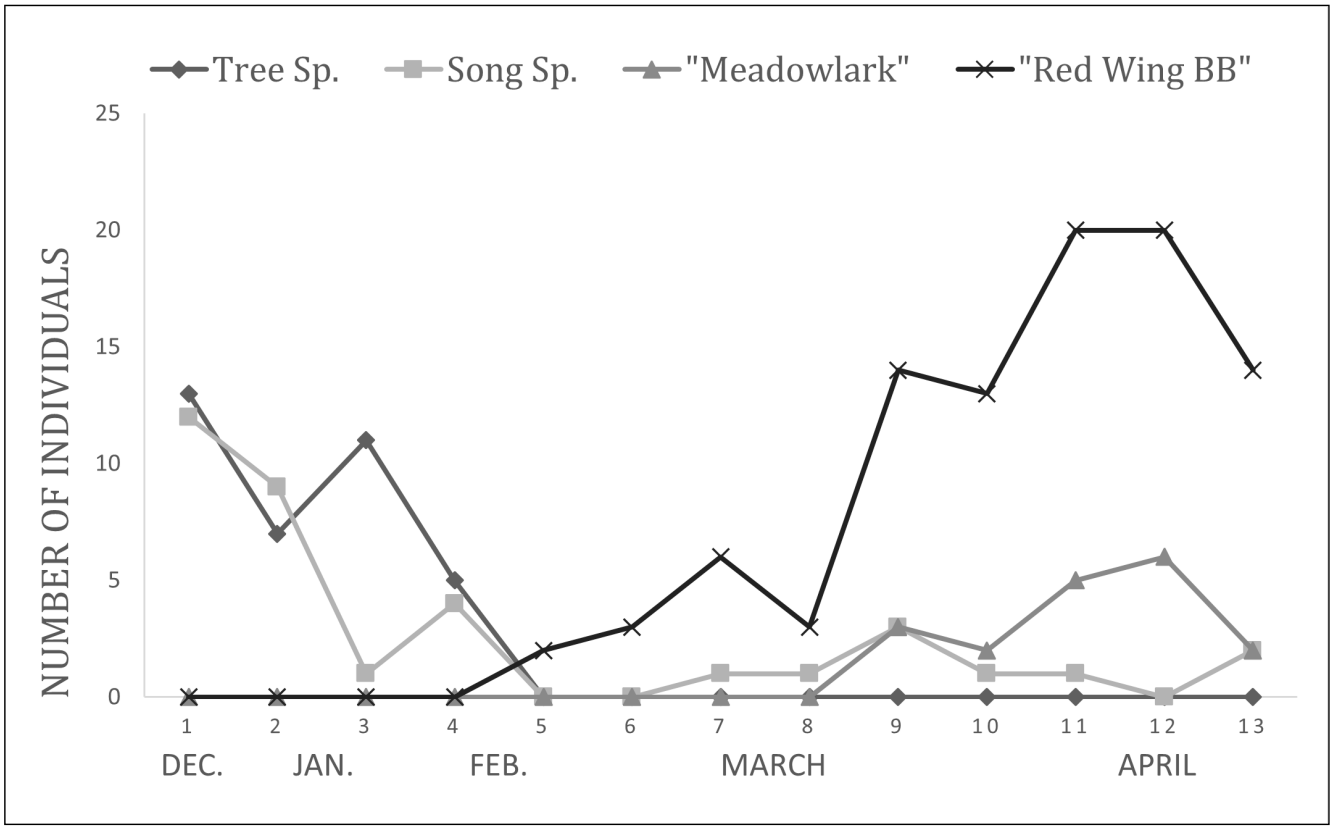

FIGURE 4. Number of the most common bird species observations from 22 December 2020 through 28 April 2021 on the warm-season switchgrass plot. Numbers on the X-axis equal weeks—with 1 week in December (1), 2 weeks each in January (2 and 3) and February (4 and 5), and 4 weeks each in March (6 to 9) and April (10 to 13).

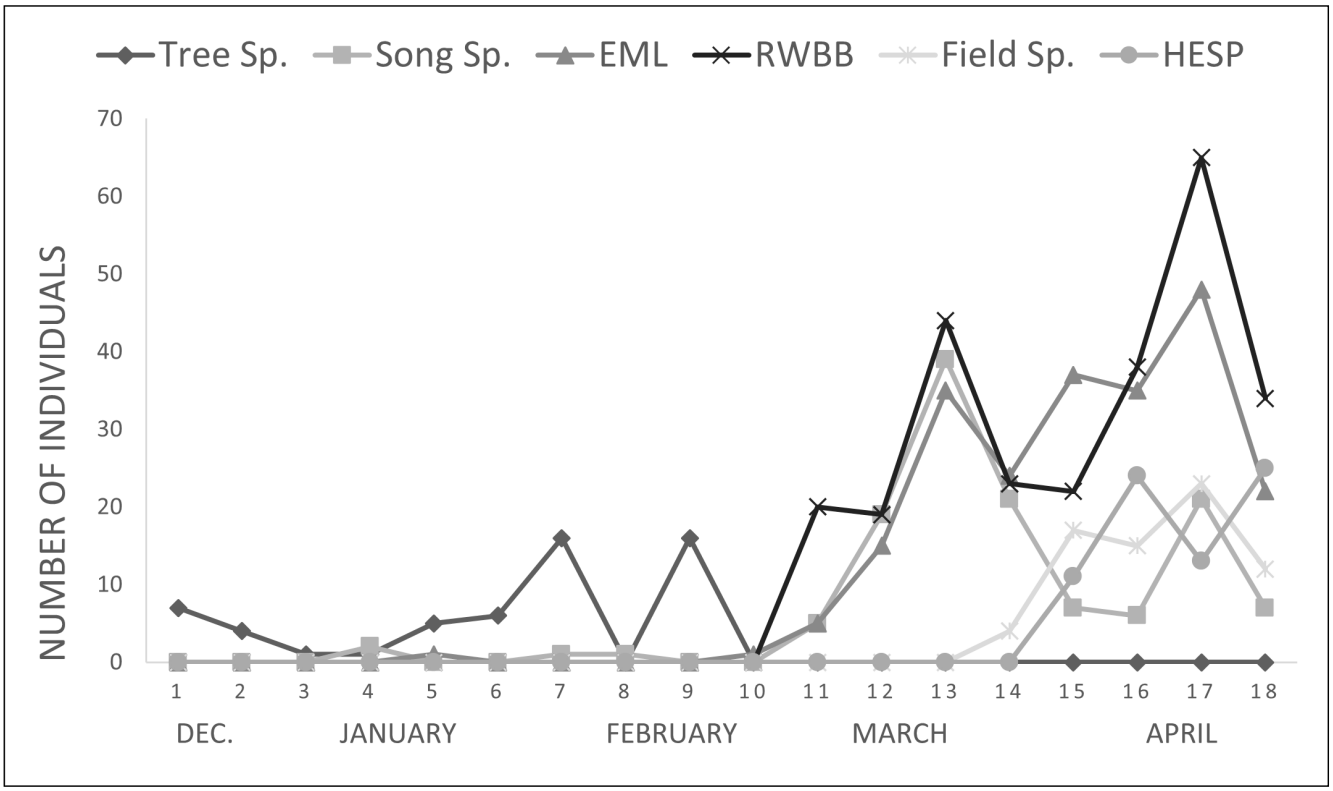

FIGURE 5. Number of the most common bird species observations from 22 December 2020 through 28 April 2021 on the cool-season mixed grass plots. Numbers on the X-axis equal weeks—with 2 weeks in December (1 and 2) and 4 weeks each in January (3 to 6), February (7 to 10), March (11 to 14), and April (15 to 18).

Table 2

Approximate return week of mid- to long-range migratory songbirds (order Passeriformes) to the study site [a]

Species	Week of return								
	February	March				April			
	4	1	2	3	4	1	2	3	4
Red-winged Blackbird [b]	X								
Eastern Towhee			X						
Field Sparrow [b]					X				
Tree Swallow						X			
Brown Thrasher						X			
Common Grackle								X	
Common Yellowthroat									X
Yellow Warbler									X
Henslow's Sparrow [b]						X			
Bobolink [c]									X
Grasshopper Sparrow									X

[a] With the exception of Red-winged Blackbirds, each of these species was initially detected in the cool-season plots.

[b] Red-winged Blackbirds, Henslow's Sparrows, and Field Sparrows were the only 3 species in this group that were observed in both cool and warm-season habitats.

[c] Bobolinks were not detected on any of the point counts; however, a few were seen between count stations during the last week of April.

DISCUSSION

In the current study it was assumed that detectability among species and habitats was reasonably similar. Sample size limitations prevented the use of detection modeling across the majority of species. Thus, these data might be best interpreted in the context of presence or absence. Count information is provided since these data were collected, but the intention is not to claim comparison of population abundances. Additionally, since there was only a single warm-season plot in this study, and it was notably smaller than the 2 cool-season sites, inferences based on comparison data between these habitats were limited.

This study documents a wide variety of avian diversity on a reclaimed surface mine, particularly among passerine species during the winter and early spring months. In addition, there was a high level of raptor diversity similar to what was previously reported on this site (Ingold 2010). Although Red-winged Blackbirds, Eastern Meadowlarks, and Song Sparrows were the most abundant species observed during this study, their numbers did not begin to increase notably until mid-March (with the exception of Song Sparrows in the switchgrass habitat). The predominant species observed on a consistent basis in December through February were American Tree Sparrows, Song Sparrows, and Northern Harriers. Other winter species, observed more sporadically, included Short-eared Owls, Eastern Bluebirds (*Sialia sialis*), American Goldfinches (*Spinus tristis*), Northern Shrikes, and Northern Flickers (*Colaptes auratus*). Ingold (2002) reported high densities of Red-winged Blackbirds and Eastern Meadowlarks, and moderate densities of Song Sparrows, on the ZR portion of this study site during the breeding season.

While there are no published papers examining winter passerine species on reclaimed surface mines, Davis (2001) reported that wintering American Tree Sparrows were the most abundant species occupying shrub-grasslands in the Platte River Valley, Nebraska. Davis (2001) also found that American Tree Sparrows and Western Meadowlarks (*Sturnella neglecta*) were the most common wintering species in grasslands while Red-winged Blackbirds were most prevalent in croplands. Piper and Wiley (1989) reported that wintering Song Sparrows on a biological reserve in North Carolina were most concentrated along field edges and shrubland borders—similar to the habitat structure on portions of the reclaimed mine in the current study. DeVault et al. (2002) and Ingold (2002) found Song Sparrows on a reclaimed surface mine, during the breeding season, to be common. As Song Sparrows may be found year-round in the same area (Arcese et al. 2020), it is not surprising that some individuals were present during the winter months on the current study site, both in the switchgrass plot and in patches of autumn olive and bush honey suckle in the cool-season areas.

Ingold (2010) reported similar numbers of Northern Harriers from a driving transect on and around The Wilds during the winter months, as observed in the current study; however, only a single Short-eared Owl was sighted along this transect then, compared to 25 observations during the current study. Most of the Short-eared Owls reported in the current study were observed during 5 consecutive weeks on a communal roost in the cool-season habitat. Vukovich and Ritichison (2008) reported a similar observation of Short-eared Owls using a winter roost for several consecutive days on a reclaimed mine in Kentucky. The majority of Trumpeter Swans observed in the current study were in flight and almost certainly comprise a portion of a year-round resident population of this species at The Wilds.

Eastern Meadowlarks, Red-winged Blackbirds, American Robins, Song Sparrows, Eastern Towhees, Swamp Sparrows, and Field Sparrows are all year-round residents in Ohio (Arcese et al. 2020; Carey et al. 2020; Greenlaw 2020; Herbert and Mowbray 2020; Jaster et al. 2020; Yasukawa and Searcy 2020). With the exception of a few Song Sparrows, Swamp Sparrows, and Red-winged Blackbirds , these species were not observed on The Wilds site until March. This suggests that these species either migrate at least short distances during the winter months or occupy different habitat types in this region during the winter. Conversely, with the exception of Henslow's Sparrows which arrived back during the first week of April, long distance migrants including Grasshopper Sparrows, Bobolinks, Common Yellowthroats, and Yellow Warblers did not arrive back on this site until late April. Peterjohn (2001) reported that spring migrant Henslow's Sparrows in Ohio generally returned in mid-April to mid-May. However, the earliest reports of returning

Henslow's in Ohio were in late March (Peterjohn 2001) which is earlier than the return date reported here for this species. A late April return date for Grasshopper Sparrows, Bobolinks, Common Yellowthroats, and Yellow Warblers is about in line with the late-April to early-May return dates for these species in Ohio (Peterjohn 1989; Guzy and Ritchison 2020; Lowther et al. 2020; Renfrew et al. 2020; Vickery 2020). Ingold et al. (2010) and Ingold and Dooley (2013) reported each of these species on this site during earlier breeding seasons. The heterogeneity of landscape on this reclaimed surface-mine site, ranging from grasslands to shrublands to patches of trees, provides for a broad range of habitat types that support these species (Ingold and Dooley 2013).

In the current study, returning obligate grassland bird species were uncommon to absent in the warm-season plot dominated by switchgrass. Rather, the predominate species on this plot—from late December through early February—were American Tree Sparrows and Song Sparrows with a gradual shift to Red-winged Blackbirds and Swamp Sparrows in March and April. Obligate grassland species, including Henslow's Sparrows and Grasshopper Sparrows, reported in warm-season plantings during the breeding season (Walk and Warner 2000; Giuliano and Daves 2002; Murray and Best 2003; Bakker and Higgins 2009), were not attracted to the tall, dense vegetation structure of this plot.

Conversely, this warm-season plot provided attractive habitat to a few generalist species including Song Sparrows, Swamp Sparrows, American Tree Sparrows, and Red-winged Blackbirds. Murray et al. (2003) and Roth et al. (2005) both reported that native warm-season plantings dominated by switchgrass may disproportionately benefit more generalist grass and shrubland birds such as Common Yellowthroats and Red-winged Blackbirds. Ingold and Dooley (unpublished data) have observed relatively high densities of both of these species in this switchgrass plot during several breeding seasons.

Overall species richness on this reclaimed surface mine site was low during late-December through February. It is possible that deep snow accumulation throughout February contributed to this trend. American Tree Sparrows and Northern Harriers were prevalent during the winter months (January through mid-March) in both the cool season and switchgrass habitats. The cool-season portions of this site were also occupied periodically by additional winter migrants including Northern Shrikes, Short-eared Owls, and Rough-legged Hawks (*Buteo lagopus*) (see also Ingold 2010). Although not observed during this survey, Lapland Longspurs were sighted in February during road surveys in cool-season habitat on this site (personal observation). New species arrivals on all plots increased notably in early March and continued through the duration of this study. These species were mostly returning migrants that have been documented to nest on this site during previous years. Although bird species richness and abundance were the only measures of habitat quality in this study, the diverse habitat structure comprising the cool-season plots appear to provide suitable wintering habitat for a few species and suitable pre-breeding habitat for several returning migrant species. The switchgrass plot was characterized by relatively high numbers of American Tree Sparrows during the first half of this study; however, overall species richness in this plot, throughout this study, was substantially lower than the cool-season areas. This may, in part, be the result of the relatively small size of the switchgrass plot as well as its homogenized habitat structure. A consistent burning regime on this warm-season plot could attract a greater diversity of winter raptors (Hovic et al. 2017), as well as some breeding grassland birds (personal observation).

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LITERATURE CITED

Arcese P, Sogge MK, Marr AB, Patten MA. 2020. Song Sparrow (*Melospiza melodia*), version 1.0. In: Poole AF, Gill FB, editors. Birds of the World. Ithaca (NY): Cornell Lab of Ornithology. https://doi.org/10.2173/bow.sonspa.01

Bajema RA, DeVault TL, Scott PE, Lima SL. 2001. Reclaimed coal mine grasslands and their significance for Henslow's Sparrows in the American Midwest. Auk. 118(2):422-431 https://doi.org/10.1093/auk/118.2.422

Bakker KK, Higgins KF. 2009. Planted grasslands and native sod prairie: equivalent habitat for grassland birds? West N Am Naturalist. 69(2):235-242. https://doi.org/10.3398/064.069.0212

Beason RC. 2020. Horned Lark (*Eremophila alpestris*), version 1.0. In: Billerman SM, editor. Birds of the World. Ithaca (NY): Cornell Lab of Ornithology. https://doi.org/10.2173/bow.horlar.01

Butler CJ. 2003. The disproportionate effect of global warming on the arrival dates of short-distance migratory birds in North America. Ibis. 145(3):484-495. https://doi.org/10.1046/j.1474-919X.2003.00193.x

Carey M, Burhans DE, Nelson DA. 2020. Field Sparrow (*Spizella pusilla*), version 1.0. In: Poole AF, editor. Birds of the World. Ithaca (NY): Cornell Lab of Ornithology. https://doi.org/10.2173/bow.fiespa.01

Davis CA. 2001. Abundance and habitat associations of birds wintering in the Platte River Valley, Nebraska. Great Plains Res. 11(2):233-248. https://www.jstor.org/stable/23777984

Dooley JL Jr, Murray AL. 2006. Population responses of *Microtus pennsylvanicus* across a chronological sequence of habitat alteration. Ohio J Sci. 106(3):93-97. http://hdl.handle.net/1811/36463

DeVault TL, Scott PE, Bajema RA, Lima SL. 2002. Breeding bird communities of reclaimed coal-mine grasslands in the American midwest. J Field Ornithol. 73(3):268-275. https://doi.org/10.1648/0273-8570-73.3.268

Galligan EW, DeVault TL, Lima SL. 2006. Nesting success of grassland and savannah birds on reclaimed surface coal mines of the midwestern United States. Wilson J Ornithol. 118(4):537-546. https://doi.org/10.1676/05-086.1

Giuliano WM, Daves SE. 2002. Avian response to warm-season grass use in pasture and hayfield management. Biol Conserv. 106(1):1-9. https://doi.org/10.1016/S0006-3207(01)00126-4

Greenlaw JS. 2020. Eastern Towhee (*Pipilo erythrophthalmus*), version 1.0. In: Rodewald PG, editor. Birds of the World. Ithaca (NY): Cornell Lab of Ornithology. https://doi.org/10.2173/bow.eastow.01

Guzy MJ, Ritchison G. 2020. Common Yellowthroat (*Geothlypis trichas*), version 1.0. In: Rodewald PG, editor. Birds of the World. Ithaca (NY): Cornell Lab of Ornithology. https://doi.org/10.2173/bow.comyel.01

Hegerl GC, Zwiers FW, Braconnot P, Gillett NP, Luo Y, Marengo Orsini JA, Nicholls N, Penner JE, Stott PA. 2007. Understanding and attributing climate change. In: Solomon S, Qin D, Manning M, Chen Z, Marquis M, Averyt KB, Tignor M, Miller HL, editors. Climate change 2007: the physical science basis. Cambridge (UK): Cambridge University Press. p. 663-745, chapter 9. https://www.ipcc.ch/report/ar4/wg1/

Herbert JA, Mowbray TB. 2020. Swamp Sparrow (*Melospiza georgiana*), version 1.0. In: Rodewald PG, editor. Birds of the World. Ithaca (NY): Cornell Lab of Ornithology. https://doi.org/10.2173/bow.swaspa.01

Herkert JR, Vickery PD, Kroodsma DE. 2020. Henslow's Sparrow (*Centronyx henslowii*), version 1.0. In: Rodewald PG, editor. Birds of the World. Ithaca (NY): Cornell Lab of Ornithology. https://doi.org/10.2173/bow.henspa.01

Hovic TJ, McGranahan DA, Elmore RD, Weir JR, Fuhlendorf SD. 2017. Pyric-carnivory: raptor use of prescribed fires. Ecol Evol. 7(21):9144-9150. https://doi.org/10.1002/ece3.3401

Hussell DJT, Montgomerie R. 2020. Lapland Longspur (*Calcarius lapponicus*), version 1.0. In: Billerman SM, Keeney BK, Rodewald PG, Schulenberg TS, editors. Birds of the World. Ithaca (NY): Cornell Lab of Ornithology. https://doi.org/10.2173/bow.laplon.01

Ingold DJ. 2002. Use of a reclaimed stripmine by grassland nesting birds in east-central Ohio. Ohio J Sci. 102(3):56-62. http://hdl.handle.net/1811/23929

Ingold DJ. 2010. Abundance and habitat use of winter raptors on a reclaimed surface mine in southeastern Ohio. Ohio J Sci. 110(4):70-76. http://hdl.handle.net/1811/52794

Ingold DJ, Dooley JL, Cavender N. 2010. Nest-site fidelity in grassland birds on mowed versus unmowed areas on a reclaimed surface mine. Northeast Nat. 17(1):125-134. https://doi.org/10.1656/045.017.0110

Ingold DJ, Dooley JL. 2013. Nesting success of grassland and shrub-nesting birds on The Wilds, an Ohio reclaimed surface mine. Ohio J Sci. 111(2-5):37-41. http://hdl.handle.net/1811/53719

Inkley DB, Anderson MG, Blaustein AR, Burkett VR, Felzer B, Griffith B, Price J, Root TL. 2004. Global climate change and wildlife in North America. Bethesda (MD): The Wildlife Society. 26 p. Wildlife Society Technical Review 04-2. https://wildlife.org/wp-content/uploads/2014/05/ClimateChange04-2.pdf

Jaster LA, Jensen WE, Forbes AR. 2014. Nest survival of grassland birds in warm- and cool-season grassland restorations. Am Midl Nat. 171(2):246-257. https://doi.org/10.1674/0003-0031-171.2.246

Jaster LA, Jensen WE, Lanyon WE. 2020. Eastern Meadowlark (*Sturnella magna*), version 1.0. In: Poole AF, editor. Birds of the World. Ithaca (NY): Cornell Lab of Ornithology https://doi.org/10.2173/bow.easmea.01

Lowther PE, Celada C, Klein NK, Rimmer CC, Spector DA. 2020. Yellow Warbler (*Setophaga petechia*), version 1.0. In: Poole AF, Gill FB, editors. Birds of the World. Ithaca (NY): Cornell Lab of Ornithology. https://doi.org/10.2173/bow.yelwar.01

Marra PP, Francis CM, Mulvihill RS, Moore FR. 2005. The influence of climate on the timing and rate of spring bird migration. Oceologia. 142:307-315. https://doi.org/10.1007/s00442-004-1725-x

Miller-Rushing AJ, Lloyd-Evans TL, Primack RB, Satzinger P. 2008. Bird migration times, climate change, and changing population sizes. Glob Change Biol. 14(9):1959-1972. https://doi.org/10.1111/j.1365-2486.2008.01619.x

Mills AM. 2005. Changes in the timing of spring and autumn migration in North American migrant passerines during a period of global warming. Ibis. 147(2):259-269. https://doi.org/10.1111/j.1474-919X.2005.00380.x

Monroe MS, Ritchison G. 2005. Breeding biology of Henslow's Sparrows on reclaimed coal mine grasslands in Kentucky. J Field Ornithol. 76(2):143-149. https://doi.org/10.1648/0273-8570-76.2.143

Montgomerie R, Lyon B. 2020. Snow Bunting (*Plectrophenax nivalis*), version 1.0. In: Billerman SM, Keeney BK, Rodewald PG, Schulenberg TS, editors. Birds of the World. Ithaca (NY): Cornell Lab of Ornithology. https://doi.org/10.2173/bow.snobun.01

Murray LD, Best LB. 2003. Short-term bird response to harvesting switchgrass for biomass in Iowa. J Wildlife Manage. 67(3):611-621. https://doi.org/10.2307/3802718

Murray LD, Best LB, Jacobsen TJ, Braster ML. 2003. Potential effects on grassland birds of converting marginal cropland to switchgrass biomass production. Biomass and Bioenerg. 25(2):167-175. https://doi.org/10.1016/S0961-9534(02)00187-3

Naugler CT, Pyle P, Patten MA. 2020. American Tree Sparrow (*Spizelloides arborea*), version 1.0. In: Rodewald PG, editor. Birds of the World. Ithaca (NY): Cornell Lab of Ornithology. https://doi.org/10.2173/bow.amtspa.01

Paruk JD, Cade TJ, Atkinson EC, Pyle P, Patten MA. 2020. Northern Shrike (*Lanius borealis*), version 1.0. In: Billerman SM, editor. Birds of the World. Ithaca (NY): Cornell Lab of Ornithology. https://doi.org/10.2173/bow.norshr4.01

Peterjohn BG. 1989. The birds of Ohio. Bloomington (IN): Indiana University Press. 237 p. ISBN 13: 9780253341839.

Peterjohn BG. 2001. The birds of Ohio: with Ohio breeding bird atlas maps. Wooster (OH): Wooster Book Company. 637 p. ISBN 13: 9781888683882.

Piper WH, Wiley RH. 1989. Correlates in dominance in wintering white-throated sparrows: age, sex and location. Anim Behav. 37(2):298-310. https://doi.org/10.1016/0003-3472(89)90119-X

Räisänen J, Ruokolainen L. 2008. Estimating present climate in a warming world: a model-based approach. Clim Dynam. 31:573-585. https://doi.org/10.1007/s00382-007-0361-7

Ralph CJ, Sauer JR, Droege S. 1995. Monitoring bird populations by point counts. Albany (CA): U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 187 p. General Technical Report PSW-GTR-149. https://doi.org/10.2737/PSW-GTR-149

Renfrew R, Strong AM, Perlut NG, Martin SG, Gavin TA. 2020. Bobolink (*Dolichonyx oryzivorus*), version 1.0. In: Rodewald PG, editor. Birds of the World. Ithaca (NY): Cornell Lab of Ornithology. https://doi.org/10.2173/bow.boboli.01

Rosenberg KV, Dokter AM, Blancher PJ, Sauer JR, Smith AC, Smith PA, Stanton JC, Panjabi A, Helft L, Parr M, Marra PP. 2019. Decline of the North American avifauna. Science. 366(6461):120-124. https://doi.org/10.1126/science.aaw1313

Roth AM, Sample DW, Ribic CA, Paine L, Undersander DJ, Bartelt GA. 2005. Grassland bird response to harvesting switchgrass as a biomass energy crop. Biomass Bioenerg. 28(5):490-498. https://doi.org/10.1016/j.biombioe.2004.11.001

Sauer JR, Pardieck KL, Ziolkowski DJ Jr, Smith AC, Hudson MR, Rodriquez V, Berlanga H, Niven DK, Link WA. 2017. The first 50 years of the North American Breeding Bird Survey. Condor. 119(3):576-593. https://doi.org/10.1650/CONDOR-17-83.1

Slankard KG, Baxley DL, Sprandel GL. 2018. The impacts of native-grassland restoration on raptors and their prey on a reclaimed surface mine in Kentucky. Northeast Nat. 25(2):277-290. https://doi.org/10.1656/045.025.0211

Stauffer GE, Diefenbach DR, Marshall MR, Brauning DW. 2011. Nest success of grassland sparrows on reclaimed surface mines. J Wildlife Manage. 75(3):548-557. https://doi.org/10.1002/jwmg.70

Swanson DL, Palmer JS. 2009. Spring migration phenology of birds in the Northern Prairie region is correlated with local climate change. J Field Ornithol. 80(4):351-363. https://doi.org/10.1111/j.1557-9263.2009.00241.x

Unger AM, Tanner EP, Harper CA, Keyser PD, Van Manen FT, Morgan JJ, Baxley DA. 2015. Northern Bobwhite seasonal habitat selection on a reclaimed surface coal mine in Kentucky. J Southeast Assoc Fish and Wildl Ag. 2:235-246.

Vickery PD. 2020. Grasshopper Sparrow (*Ammodramus savannarum*), version 1.0. In: Poole AF, Gill FB, editors. Birds of the World. Ithaca (NY): Cornell Lab of Ornithology. https://doi.org/10.2173/bow.graspa.01

Vukovich M, Ritchison G. 2008. Foraging behavior of Short-eared Owls and Northern Harriers on a reclaimed surface mine in Kentucky. Southeast Nat. 7(1):1-10. https://doi.org/10.1656/1528-7092(2008)7[1:FBOSOA]2.0.CO;2

Walk JW, Warner RE. 2000. Grassland management for the conservation of songbirds in the Midwestern USA. Biol Conserv. 94(2):165-172. https://doi.org/10.1016/S0006-3207(99)00182-2

Wheelwright NT, Rising JD. 2020. Savannah Sparrow (*Passerculus sandwichensis*), version 1.0. In: Poole AF, editor. Birds of the World. Ithaca (NY): Cornell Lab of Ornithology. https://doi.org/10.2173/bow.savspa.01

Yasukawa K, Searcy WA. 2020. Red-winged Blackbird (A*gelaius phoeniceus*), version 1.0. In: Rodewald PG, editor. Birds of the World. Ithaca (NY): Cornell Lab of Ornithology. https://doi.org/10.2173/bow.rewbla.01