Non-blackbird Avian Occurrence and Abundance in North Dakota Sunflower Fields

DIONN A. SCHAAF[1], GEORGE M. LINZ[2], CURT DOETKOTT, MARK W. LUTMAN[3], and WILLIAM J. BLEIER

Department of Biological Sciences, North Dakota State University, Fargo, ND 58105 (DAS, MWL, WJB)
U.S. Department of Agriculture, Wildlife Services, National Wildlife Research Center, Bismarck, ND 58501 (GML)
Information Technology Services, North Dakota State University, Fargo, ND 58105 (CD)

ABSTRACT -- Sunflower fields are well-documented as foraging habitat for fall-migrating blackbirds (Family Icteridae). There is, however, a paucity of information on the use of sunflower fields by non-blackbirds. We assessed non-blackbird use of 12 ripening sunflower fields in the Prairie Pothole Region of central North Dakota. From mid-August to mid-October 2000, we counted 4,129 individual birds, consisting of 22 families and 61 species, in the sample fields and within 5 m of the field edges. We saw the largest number of birds from 18 September to 27 September. The Family Emberizidae (sparrows) accounted for 26% of the species and 20% of the individual birds recorded. We also assessed the influence of habitat factors in and around sunflower fields on bird numbers and found that grass and weeds in sunflower fields were correlated significantly with bird abundance. High species richness and abundance suggested that ripening sunflower fields and associated landscape features provided habitat in the northern Great Plains for fall migrating birds.

[1]Current address: Foster County Soil Conservation District, 6720 Hwy 200, Carrington, ND 58421.
[2]Corresponding author. E-mail address: George.M.Linz@usda.gov
[3]Current address: U. S. Department of Agriculture, Wildlife Services, Fort Collins, CO 80521.

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Most avian ecology studies are conducted during the breeding season, leaving a gap in our knowledge of bird-habitat relationships at other times of the year (Peterjohn 2003, Tankersley and Orvis 2003), especially during migration (Moore et al. 1994, Hutto 1998, Igl and Ballard 1999). Little is understood about migration as a whole, and even less is known about specific stages within migration (Russell et al. 1994), particularly stopovers, when replenishing of fat stores occurs (Kelly et al. 1999).

Extensive landscape changes have occurred on the northern Great Plains over the past century (Kantrud et al. 1989). Wetlands have been drained, agricultural fields have replaced much of the native grassland, and planted trees have brought many eastern forest birds west of their former range (Sprunt 1975). Although crop fields generally are considered poor long-term habitat for birds (Galle et al. 2004), crop fields can be critical stopover sites for migrants and over-wintering birds (Best et al. 1998, Boutin et al. 1999, Linz et al. 2004). Availability of energy during stopover periods is critical for determining the speed and success of migration (Schaub and Jenni 2001, Rodewald and Brittingham 2002).

North Dakota growers annually harvest nearly 50% of the 1.1 million ha of commercial sunflower grown in the United States (NDASS 2003). Sunflower is planted at a rate of 40,000 to 50,000 plants/ha from mid-May to mid-June, forms a dense leafy canopy by late July, and is usually harvested in October and November. Sunflower fields are well-known for providing a foraging habitat for blackbirds (Family Icteridae) from the onset of seed formation in mid-August until harvest (Linz and Hanzel 1997, Peer et al. 2003). As one of last crops to be harvested, sunflower might provide habitat for non-blackbirds as well.

In fall 2000, we identified and quantified non-blackbirds in 12 ripening sunflower fields in North Dakota. We measured habitat parameters in and around the fields, in an attempt to correlate these factors with the number of non-blackbirds in the fields. Our aim was to evaluate sunflower as habitat for post-breeding birds.

STUDY AREA

We conducted our study in Barnes and Stutsman counties, in east-central North Dakota (47.0° N, 98.5° W). The study area lies in the southern Drift Plains in the Prairie Pothole Region (PPR) of the northern Great Plains (Kantrud et al. 1989). The landscape consists of low, rolling hills resulting from glaciation during the Wisconsin ice age, with a topsoil of fertile glacial till (Bluemle 1977). The PPR is known for an abundance of cattail-dominated (*Typha* spp.) wetlands (Kantrud et al. 1989). Originally open mixed-grass prairie, most of the PPR now has been converted to cropland, and planted tree rows are common. In 2000, growers in these counties planted barley (125,506 ha), soybeans (87,044 ha), sunflower (64,251 ha), canola (59,700 ha), flaxseed (15,142 ha), wheat (334,210 ha), corn (51, 417 ha), and hay (76,518 ha; NDASS 2001).

METHODS

We established 10 census points in each of 12 randomly selected sunflower fields (range 26.1 - 65.8 ha). Six census points were located 25 m from the field perimeter with a minimum inter-distance of 200 m. Four census points were located in the field interior at a distance from other points of at least 50 m and no farther than the lesser of 300 m or half the width of the field. Each field had at least one wetland within 75 m of the field edge.

Between 22 August and 11 October, two trained observers (DAS and MWL) counted birds from a 1.8 m stepladder in each field 7 times. Except for the last round, which was altered to accommodate the growers' harvest plans, fields were visited in the same order during each round of surveys. The direction of travel to the count points was reversed from the previous visit and the two observers alternated among fields.

We began each survey 15 min after sunrise. We maintained a 2-min quiet period at each census point, followed by an 8-min survey, which was divided into the first 5 min and last 3 min. We recorded distance and habitat where the bird was first detected. Counts were completed in 3 to 4 hr, depending on the distance between count points.

We collected vegetation data from 31 August to 19 September and from 23 September to 3 October. We established three 1-m diameter vegetation plots around each census point and identified all plant species. Percent cover was estimated for grasses, and the number of stems was counted for all forbs and for sunflower. We took aerial photographs of the fields and surrounding habitat with a Cannon EOS 650 35-mm SLR camera loaded with Ektachrome 100 film. These photographs were rectified, then analyzed by using ArcView GIS 3.2 (Mitchell 1999) software to quantify the area of available habitat cover types. Habitat area was determined within 100 m of a census point by using concentric 25 m buffers, and within 805 m (width of a legal quarter section, a common size for adjacent fields) of the study field. Distance to each habitat type and distance to sunflower edge also were measured from each census point. Nearby crops were identified by using the 2000 National Agricultural Statistics Service Cropland Data Layer for North Dakota (NASS 2000).

Descriptive statistics (Johnson 1977) were calculated for bird observations within 25 m of each census point, both for foraging groups and for species seen on greater than or equal to 10% of surveys. Due to heavy foliage cover, the majority of birds were detected less than or equal to 25 m. The bird groups used in the data analysis were warblers, all insect- and fruit-eating birds, sparrows, non-blackbird granivores, and all non-blackbird bird species. Descriptive statistics were calculated for the area of different habitat types and wetland classes within 805 m of the fields. Descriptive statistics also were calculated for sunflower density, grass cover, and forb counts on each field, and for all plant species that occurred on greater than or equal to 10% of all census points.

We used Pearson product-moment correlations to examine bird-habitat relationships for birds counted in sunflower less than or equal to 25 m of the count points. The bird groups used in the data analysis were warblers, all insect- and fruit-eating birds, sparrows, non-blackbird granivores, and all non-blackbird species. We also correlated the number of birds detected in each field against the proportion of each habitat type less than or equal to 805 m of the fields and against vegetation factors at the field level. The small sample size ($N = 12$) makes weak correlations unreliable; therefore, only strong correlations ($r \geq 0.6$) are reported. Strong, statistically significant correlations that appeared to be driven by outliers also were rejected.

RESULTS

Within the perimeter of the sunflower fields, wetlands were the main noncrop habitat (Fig. 1). The most common habitat types around sunflower fields were small grains and wetlands. All study fields had small areas of adjacent tree rows. The only plant species meeting the occurrence criterion (present on at least 10% of all census points) were pigeongrass (*Setaria viridis*), black nightshade (*Solanum ptychanthum*), and field sowthistle (*Sonchus arvensis*). The percent coverage of all grasses (mostly pigeongrass) and stem counts of forbs (black nightshade and field sowthistle) varied among fields. Mean sunflower density was similar among fields, averaging 4.6 stems/1-m diameter circle (± 0.28 95% C.I.). Visual obstruction and canopy cover changed as the plants matured and the leaves wilted. This increased visibility of birds within a few meters of the census point, but very few birds would approach that close to the observer. The majority of birds observed continued to be those perched on or near the sunflower heads.

Due to time of year and post-breeding status of birds, most birds were calling rather than singing. We detected 69% of birds during the first 5 min of the 8-min counts. About 88% of birds were detected either by sight or by both sight and sound. Only common yellowthroat (*Geothlypis trichas*) could be identified by calls.

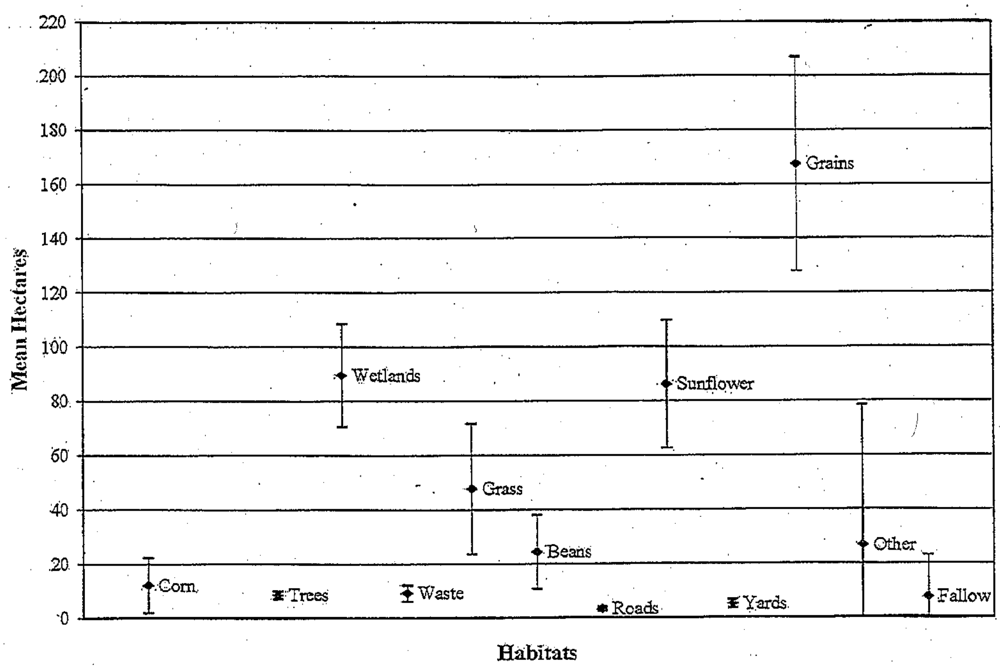

Figure 1. Mean area (± 95% CI) of habitat types within 805 m of 12 sunflower fields in Barnes and Stutsman counties, North Dakota.

We counted 4,129 individual birds, consisting of 22 families and 61 species, in the sample fields and within 5 m of the field edges. We observed 2,405 in or foraging just above the sunflowers, including 246 (10%) unidentified passerines. The Family Emberizidae (sparrows) accounted for 33% of the species and 38% of the individual birds recorded in sunflower (Table 1). The Families Fringillidae (finches) and Columbidae (doves) made up 17% and 8%, respectively, of the birds counted. Other notable granivores included gallinaceous birds (Family Phasianidae), crows and jays (Family Corvidae), and black-capped chickadee (*Poecillus articapillus*) (Family Paridae). We also observed four species of swallows (Family Hirundinidae) foraging over the fields and four species of warblers (Family Parulidae) feeding in the canopy of the sunflowers. These two families of insectivores made up 13% of the total number of birds counted in the fields. Raptors, especially northern harrier (*Circus cyaneus*) (Family Accipitridae), commonly were observed searching the fields for prey.

Seven bird species were observed on greater than 10% of the counts. These species included American goldfinch (*Carduelis tristis*) (mean = 5.9 ± 1.68 95% CI), American robin (*Turdus migratorus*) (mean = 1.1 ± 0.79 95% CI), clay-colored sparrow (*Spizella pallida*) (mean = 0.5 ± 0.28 95% CI), mourning dove (*Zenaida*

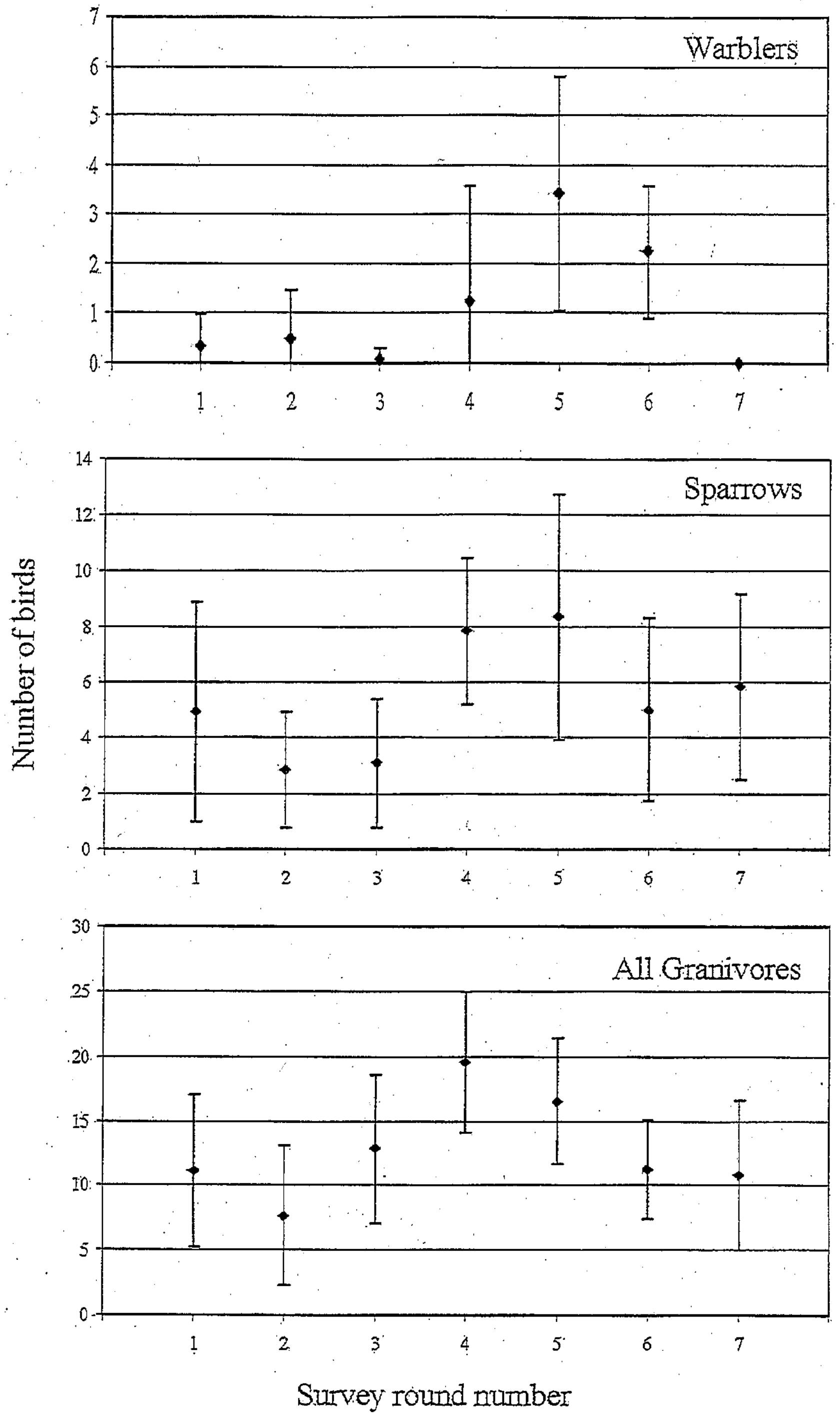

Figure 2. Mean number (± 95% CI) of common bird groups observed in 12 sunflower fields during survey rounds in Barnes and Stutsman counties, North Dakota. Round 1 - August 22-30, Round 2 - August 29-September 6, Round 3 - September 4-12, Round 4 - September 12-19, Round 5 - September 18-27, Round 6 - September 27-October 4, and Round 7 - October 4-11. Overlapping dates are due to weather delays and the use of two observers.

Table 1. Avian species detected during point counts, from mid-August to mid-October 2000; in ripening sunflower fields in Barnes and Stutsman counties, North Dakota.

Common Name	Scientific Name	Total for all Distances[ab]	Frequency of Occurrence (N=84)
Phasianidae			
Ring-necked pheasant	*Phasianus colchicus*	11	6
Gray partridge	*Perdix perdix*	1	1
Sharp-tailed grouse	*Tympanuchus phasianellus*	19	3
Accipitridae			
Northern harrier	*Circus cyaneus*	59	39
Sharp-shinned hawk	*Accipiter striatus*	5	5
Swainson's hawk	*Buteo swainsoni*	8	6
Red-tailed hawk	*Buteo jamaicensis*	3	3
Unidentified hawk	*Accipiter* sp.	1	1
Falconidae			
American kestrel	*Falco sparverius*	1	1
Charadriidae			
Killdeer	*Charadrius vociferus*	22	10
Scolopacidae			
Common snipe	*Gallinago gallinago*	1	1
Columbidae			
Rock pigeon	*Columba livia*	22	5
Mourning dove	*Zenaida macroura*	437	73
Unidentified Strigidae		1	1
Apodidae			
Chimney swift	*Chaetura pelagica*	1	1
Trochilidae			
Ruby-throated hummingbird	*Archilochus colubris*	1	1
Picidae			
Downy woodpecker	*Picoides pubescens*	6	6
Hairy woodpecker	Picoides villosus	1	1
Northern flicker	*Colaptes auratus*	6	4
Tyrannidae			
Willow flycatcher	*Empidonax traillii*	3	2
Unidentified flycatcher	*Empidonax* spp.	4	3
Western kingbird	*Tyrannus verticalis*	2	1
Eastern kingbird	*Tyrannus tyrannus*	24	8

Table 1, continued.

Common Name	Scientific Name	Total for all Distances[ab]	Frequency of Occurrence (N=84)
Corvidae			
Blue jay	*Cyanocitta cristata*	53	12
American Crow	*Corvus brachyrhynchos*	54	15
Hirundinidae			
Tree swallow	*Tachycineta bicolor*	25	9
Northern rough-winged swallow	*Stelgidopteryx serripennis*	92	12
Barn swallow	*Hirundo rustica*	224	37
Bank swallow	*Riparia riparia*	67	11
Paridae			
Black-capped chickadee	*Poecile atricapillus*	35	17
Troglodytidae			
House wren	*Troglodytes aedon*	12	8
Sedge wren	*Cistothorus platensis*	2	2
Marsh wren	*Cistothorus palustris*	28	14
Unidentified wren		1	1
Turdidae			
American robin	*Turdus migratorius*	249	46
Mimidae			
Brown thrasher	*Toxostoma rufum*	1	1
Parulidae			
Yellow-rumped warbler	*Dendroica coronata*	29	8
Palm warbler	*Dendroica palmarum*	97	14
Mourning warbler	*Oporornis philadelphia*	1	1
Common yellowthroat	*Geothlypis trichas*	22	16
Unidentified Warblers		14	9
Emberizidae			
American tree sparrow	*Spizella arborea*	1	1
Clay-colored sparrow	*Spizella pallida*	55	21
Field sparrow	*Spizella pusilla*	22	12
Vesper sparrow	*Pooecetes gramineus*	18	7
Savannah sparrow	*Passerculus sandwichensis*	66	17
Grasshopper sparrow	*Ammodramus savannarum*	131	7
Le Conte's sparrow	*Ammodramus leconteii*	3	3
Sharp-tailed sparrow	*Ammodramus nelsoni*	1	1
Song sparrow	*Melospiza melodia*	175	44
Lincoln's sparrow	*Melospiza lincolnii*	26	11
Swamp sparrow	*Melospiza georgiana*	1	1

Table 1, continued.

Common Name	Scientific Name	Total for all Distances[ab]	Frequency of Occurrence (N=84)
White-throated sparrow	*Zonotrichia albicollis*	7	4
Harris' sparrow	*Zonotrichia querula*	37	7
White-crowned sparrow	*Zonotrichia leucophrys*	4	2
Dark-eyed junco	*Junco hyemalis*	52	9
Smith's longspur	*Calcarius pictus*	8	3
Unidentified sparrows		237	67
Icteridae[a]			
Bobolink	*Dolichonyx oryzivorus*	1	1
Western meadowlark	*Sturnella neglecta*	6	2
Brown-headed cowbird	*Molothrus ater*	3	1
Orchard oriole	*Icterus spurius*	1	1
Baltimore oriole	*Icterus galbula*	1	1
Fringillidae			
Purple finch	*Carpodacus purpureus*	2	1
House finch	*Carpodacus mexicanus*	1	1
American goldfinch	*Carduelis tristis*	1280	82
Passeridae			
House sparrow	*Passer domesticus*	1	1
Unidentified Passerines		343	43
Unidentified bird		1	1

[a]Counts are based on the total for 10 census points per field. Red-winged blackbird (*Agelaius phoeniceus*), yellow-headed blackbird (*Xanthocephalus xanthocephalus*), and common grackle (*Quiscalus quiscula*) are not included.
[b]Birds beyond 25 m were counted only if identifiable at least to genus.

macroura) (mean = 1.0 ± 0.27 95% CI), savannah sparrow (*Passerculus sandwichensis*) (mean = 0.6, ± 0.60 95% CI), song sparrow (*Melospiza melodia*) (mean = 1.1 ± 0.47 95% CI), and palm warbler (*Dendrocia palmarum*) (mean = 0.6 ± 0.76 95% CI). The numbers of warblers, sparrows, and granivores tended to vary among the seven survey rounds as the fall migration progressed (Fig. 2).

The effects of migration upon bird detections were noticeable, both when charting dates of species observations and in the pattern of numbers recorded for several species and groups of birds. In most cases, migration patterns were consistent with the expected migration periods of the birds in question. We saw the largest number of granivores and insectivores from 18 September to 27 September (Fig. 2). At this point, most of the sunflower fields had just reached physiological maturity.

Table 2. Pearson correlation coefficients for bird species and groups against proportion of habitat types around 12 study sunflower fields in Barnes and Stutsman counties, North Dakota.

Bird Species or Group	Habitat Type	r	P
Insectivores	Grass/hay	0.78	0.003
Savannah sparrow	Grass/hay	0.71	0.010
Song sparrow	Grass/hay	0.62	0.030
American robin	Yards	0.65	0.023
Non-sparrow granivores[a]	Beans	0.62	0.032
Yellow-rumped warbler	Wetlands	-0.59	0.045
Yellow-rumped warbler	Grass/hay	-0.60	0.040
Clay-colored sparrow	Grains	-0.65	0.023
Insectivores	Roads	-0.68	0.016
Savannah sparrow	Roads	-0.74	0.006

[a]Non-sparrow granivores also do not include American goldfinch, mourning dove, or blackbirds, which included red-winged blackbird, yellow-headed blackbird, and common grackle.

Table 3. Pearson correlation coefficients for bird species and groups against average vegetation measurements in 12 sunflower fields in Barnes and Stutsman counties, North Dakota.

Bird Species or Taxonomic Group	Vegetation Measurement	r	P
Insectivores[a]	% Grass cover[b]	0.76	0.004
Palm warbler	% Grass cover[b]	0.68	0.015
Palm warbler	Number of *Polygonum* stems	0.66	0.018
Savannah sparrow	Number of forb stems	0.70	0.012

[a]The most common insectivore was palm warbler.
[b]Nearly all grass cover was pigeon grass.

Pearson correlations indicated that habitat surrounding the sunflower fields influenced bird use. For example, insectivores, savannah sparrow, and song sparrow were positively associated with grass and haylands (Table 2). We found that the yellow-rumped warbler (*Dendorica coronata*) was influenced negatively by the presence of wetlands and grass and haylands, whereas insectivores and savannah sparrow were associated negatively with roads. Vegetation within fields also appeared to affect the presence of some birds (Table 3). For example, palm warbler numbers were correlated positively to percent grass cover and number of *Polygonum* spp. stems, and savannah sparrow numbers were correlated positively with the number of forb stems.

DISCUSSION

To our knowledge, our data represented the first documentation of non-blackbird species using ripening sunflower fields. We found that birds consistently used sunflower fields throughout late summer and early fall, with the largest number of birds recorded during migration in late September. Of 15 sparrow species known to breed in eastern North Dakota (Stewart 1975), we recorded 9 in sunflower fields. Of these, grasshopper sparrow and clay-colored sparrow are two species of some management concern (Thompson et al. 1993). Heavy cover and absence of singing precluded identification of a large number of sparrows, so it is possible other less common sparrow species were present.

The Eastern kingbird (*Tyrannus tyrannus*) also was common, but it begins migrating south in late August and early September (South Dakota Ornithologists' Union 1991) and was last seen in sunflower on 4 September. In comparison, the American goldfinch is a late breeder that prefers brush and shrubby habitats for nesting, and is attracted to seeds of composite plants (Middleton 1993). These preferences potentially explain why the American goldfinch is common in sunflower fields.

Bird attraction to the rich food source found in ripening sunflower and associated weeds and insects might override most other factors when selecting foraging habitat. Many birds preferred areas within the sunflower that contain grasses and other weeds; whereas, non-weedy areas farther from field edges and wetlands tended to have fewer birds. Sunflower has not been modified genetically to allow weed control with herbicides; thus, some study fields contained heavy stands of seed-bearing weeds suited for granivores. Finally, wild sunflower is native to North American and, as a result, a complex array of insect foraging guilds have adapted to living in sunflower fields (Charlet et al. 1997), that can provide migrating insectivores an abundance of prey, particularly if pesticides are not used.

We speculate that a good interspersion of habitats, including wetlands and tree rows, might enhance the attractiveness of sunflower fields. Additionally, the sunflower stalks and canopy might serve as a dense shrub-like habitat that offers concealment from predators and protection during inclement weather (Lindstrom 1990). Harvested fields will be used by residents, winter migrants, and spring migrants when the ground is free of snow (Galle et al. 2004). Leaving some standing sunflower will provide another source of cover and food during periods of heavy snow.

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