

US EPA ARCHIVE DOCUMENT

## Appendix D. Avian Data to Support Generic and Custom Species

### D.1. Introduction

According to the Checklist of Birds of North America (USGS, 2009), 742 species of birds inhabit the continental United States, Alaska and Canada. Taxonomically, these 742 species are divided into 20 orders, where the largest proportion (47%) is represented by the Passeriform order, also known as passerine (**Table D1**). As noted below (**Section D.3**), passerines are the most commonly observed species in agricultural areas.

**Table D1. Orders of Avian Species of North America (USGS, 2009).**

Order	Common names of species within order	Number of species
Anseriformes	ducks, geese, teals, swans	48
Apodiformes	swifts and hummingbirds	19
Caprimulgiformes	nightjars	8
Charadriiformes	auks, plovers, gulls, sandpipers	113
Ciconiiformes	herons, bitterns, egrets, ibis	20
Columbiformes	pigeons and doves	12
Coraciiformes	kingfisher	2
Cuculiformes	cuckoos	6
Falconiformes	falcons and hawks	31
Galliformes	Pheasants, partridges, quail	26
Gaviiformes	loons	5
Gruiformes	cranes and rails	14
Passeriformes	songbirds	349
Pelecaniformes	pelicans and cormorants	17
Piciformes	woodpeckers and sapsuckers	22
Podicipediformes	grebes	7
Procellariiformes	albatross, petrel and shearwater	17
Psittaciformes	parrots and parakeets	6
Strigiformes	owls	19
Trogoniformes	trogon	1

In TIM, a species is represented by its frequency on the agricultural field (termed: Frequency on Field, acronym: FOF), its diet and its body weight (BW). In order to parameterize generic species and to provide users with information relevant to custom species, it is necessary to identify which avian species visit agricultural fields. This can be done using census studies of avian use of agricultural fields and their adjacent habitats. This appendix summarizes several avian census studies from pesticide registrant submissions and the literature. Once representative species are identified, their diets and BWs can be defined using Gough *et al.* (1998) and Dunning (1984), respectively. The purpose of this review is to identify avian species that are representative of those that commonly visit agricultural fields. This review is not intended to be inclusive of every relevant species of birds visiting agricultural fields in North America.

## D.2. Avian Species Observed on Agricultural Fields and Orchards

There are multiple factors that can influence the species commonly observed on a field and the FOF of those observed species. Some of these factors include foraging preference, range, composition of edge habitat and time of season (Best *et al.*, 1990, Boutin *et al.*, 1996). Therefore, the crop being studied and the geographic location of the study site can influence the species observed as well as their frequencies on field. In order to account for some of these variables, 26 avian census studies in agricultural fields and edge habitats were considered from 9 different crops (alfalfa, apples, cabbage, citrus, corn, cotton, grapes, potatoes and soybeans) in different geographic locations in North America (Alabama, Arizona, California, Florida, Kansas, Illinois, Iowa, Mississippi, Nebraska, New Mexico, Oklahoma, Ontario, Texas and Wisconsin) (Table D2).

**Table D2. Crops, Locations and Dates of Avian Census Studies Used in This Appendix to Identify Common Avian Species in Agricultural Habitats.**

Crop	State/Province	County	Year	Citation
Alfalfa	Kansas	Nemaha	1988	MRID 41110701
	Oklahoma	Kingfisher	1988	MRID 41110701
Apples	Ontario	Norfolk	1987	Boutin et al. 1996
	Ontario	Norfolk	1988	Boutin et al. 1996
Cabbage	Wisconsin	Outagamie	1988	MRID 41585001
Citrus	California	Tulare	1992	MRID 43730301
Corn	Florida	Wikewa Springs	1986	MRID 40149501
	Iowa	Story and Boone	1986	Best et al. 1990
	Illinois	Greene	1986	Best et al. 1990
	Illinois	Greene	1990	MRID 41742701
	Nebraska	Buffalo and Dawson	1988	MRID 41110601
	Ontario	Essex, Niagara and Norfolk	1987	Boutin et al. 1996
	Ontario	Essex, Niagara and Norfolk	1988	Boutin et al. 1996
	Texas	Willacy	1986	MRID 40149501
Cotton	Texas/New Mexico	Dallam/Union	1988	MRID 41110601
	Alabama	Lee and Macon	1988	MRID 41548803
	Alabama/Mississippi	Lee/Macon and Leflore	1993	MRID 43492814
	Alabama/Mississippi	Lee/Macon and Leflore	1995	MRID 44464202
	Arizona	La Paz and Yuma	1993	MRID 43492814
	Arizona	La Paz and Yuma	1995	MRID 44464202
	Texas	Tom Green and Dawson	1993	MRID 43492814
Grapes	Texas	Burleson, Williamson and Milam	1995	MRID 44464202
	Ontario	Niagara	1987	Boutin et al. 1996
Potatoes	New Jersey	Salem, Cumberland and Atlantic	1990	MRID 42333001
Soybeans	Ontario	Essex	1987	Boutin et al. 1996
	Ontario	Essex	1988	Boutin et al. 1996

The field studies described in this appendix were generally designed with multiple agricultural fields, orchards or vineyards. Birds were surveyed repeatedly over several weeks in the same transects. Each field had multiple transects that overlapped with either field, edge or field and edge habitat. Surveys generally occurred during the morning hours for standard durations. During a

survey, individual birds within a species were counted. Bird species were identified by sight and song.

FOF values used in TIM are based on observations of individuals within a bird species and within an agricultural field and its edge habitat. The FOF is a measure of the percent of the total number of individuals (of one species) observed at one time period that were observed within the agricultural field. This is used as a surrogate for the mean FOF of individual birds within a species.

The commonly observed avian species and their associated FOF values from these studies are described below. It should be noted that definitions of “commonly” observed species differ by study because of different study designs and reported results. An effort was made here to standardize the FOF results whenever possible. Species observed infrequently during avian census studies are not considered for determining species-specific FOF values due to the low number of individuals observed and the uncertainty in the resulting FOF.

One notable uncertainty associated with these data is that the majority of the census studies were conducted during the spring and summer months. Therefore, FOF values representative of fall and winter months are unknown.

#### **D.2.1. Alfalfa in Kansas and Oklahoma**

Two avian census studies were conducted on alfalfa fields during 6 weeks in the summer of 1988. One study was located in Kansas (April 1 – June 20) and the other was located in Oklahoma (March 16-June 10). Each study involved surveys of 16 different fields, ranging in size from 14.3 to 75 acres. In the Kansas study, 119 different species were identified. In the Oklahoma study, 86 different species were identified. The study authors reported the avian census results in average number of birds observed per 10 ha on the field and in the edge habitat per week. Over the 6-week observation periods, the number of individuals and FOF values for each species varied by field. For the current analysis, “commonly” observed species are defined as those that were observed an average of at least 10 times per week on at least one study field. The commonly observed species on the fields in Kansas and Oklahoma and their FOF values (range and average) are provided in **Tables D3 and D4**, respectively (MRID 41110701). Although the two studies were located in different states, they shared several common species.

**Table D3. Commonly Observed Species of Birds in Kansas Alfalfa Fields during Summer of 1988 (MRID 41110701).**

Species (common name)	Species (scientific name)	# fields*	Average # observations/10 ha per field per week	FOF Range (%)	Average FOF** (%)
American robin	<i>Turdus migratorius</i>	7	10-22	6-42	26
Barn swallow	<i>Hirundo rustica</i>	1	12	52	52
Black-capped chickadee	<i>Poecile atricapillus</i>	1	10	0	0
Blue jay	<i>Cyanocitta cristata</i>	1	12	4	4
Brown-headed cowbird	<i>Molothrus ater</i>	15	15-50	4-37	16
Common grackle	<i>Quiscalus quiscula</i>	1	34	2	2
Dickcissel	<i>Spiza americana</i>	6	10-19	1-68	19
Eastern kingbird	<i>Tyrannus tyrannus</i>	1	10	6	6
Grasshopper sparrow	<i>Ammodramus savannarum</i>	1	12	56	56
Harris' sparrow	<i>Zonotrichia querula</i>	3	10-91	0-13	6
House sparrow	<i>Passer domesticus</i>	2	15-154	7-47	13
House wren	<i>Troglodytes aedon</i>	2	10	0	0
Mourning dove	<i>Zenaida macroura</i>	2	10	4-39	22
Northern bobwhite	<i>Colinus virginianus</i>	3	10-12	6-66	31
Red-winged blackbird	<i>Agelaius phoeniceus</i>	5	19-48	1-16	7
Savannah sparrow	<i>Passerculus sandwichensis</i>	12	11-36	21-65	41
Vesper sparrow	<i>Pooecetes gramineus</i>	3	11-19	34-51	42
Water pipit	<i>Anthus spinoletta</i>	1	12	45	45
Western meadowlark	<i>Sturnella neglecta</i>	6	10-17	23-50	33

\* where a bird species was observed  $\geq 10$  times on average/10 ha/week

\*\*over all study fields

**Table D4. Commonly Observed Species of Birds in Oklahoma Alfalfa Fields during Summer of 1988 (MRID 41110701).**

Species (common name)	Species (scientific name)	# fields*	Average # observations/10 ha per field per week	FOF Range (%)	Average FOF** (%)
American robin	<i>Turdus migratorius</i>	4	10-26	19-36	29
Brown-headed cowbird	<i>Molothrus ater</i>	4	10-49	15-76	36
Carolina chickadee	<i>Poecile carolinensis</i>	1	12	5	5
Chipping sparrow	<i>Spizella passerina</i>	1	21	19	21
Dark-eyed junco	<i>Junco hyemalis</i>	1	11	7	11
Dickcissel	<i>Spiza americana</i>	4	12-17	8-43	29
Eastern meadowlark	<i>Sturnella magna</i>	4	11-17	77-98	88
Harris' sparrow	<i>Zonotrichia querula</i>	2	15-16	0-24	12
Killdeer	<i>Charadrius vociferus</i>	1	11	100	100
Northern cardinal	<i>Cardinalis cardinalis</i>	1	11	7	7
Red-tailed hawk	<i>Buteo jamaicensis</i>	1	13	0	0
Red-winged blackbird	<i>Agelaius phoeniceus</i>	8	12-134	0-50	19
Savannah sparrow	<i>Passerculus sandwichensis</i>	9	11-23	37-91	62
Water pipit	<i>Anthus spinoletta</i>	6	12-111	85-100	97

\* where a bird species was observed  $\geq 10$  times on average/10 ha/week

\*\*over all study fields

### D.2.2. Apples in Southern Ontario

In July – September 1987 and in May – September 1988, apple orchards and their edge habitats located in Norfolk County in Southern Ontario were surveyed for birds (Boutin *et al.*, 1996). The study authors defined commonly observed species as those that were observed in the field or edge habitat during more than 50% of the observation periods. During the two seasons of the study, 14 species were commonly observed. Mean percent of individuals within each of these species observed within the apple orchards in 1987 and in 1988 are provided in **Tables D5 and D6**, respectively. These values are representative of FOF for different species during different months. The commonly observed species and their frequency on field values varied from month to month. In some cases, species that were commonly observed in one month, were not commonly observed during another month (e.g., American goldfinch).

**Table D5. FOF Values for Commonly Observed Species of Birds in Ontario Apple Orchards in 1987 (Boutin et al., 1996).**

Species (common name)	Species (scientific name)	FOF (%)		
		July	Aug-Sep	Average
American crow	<i>Corvus brachyrhynchos</i>	68	62	65
American goldfinch	<i>Carduelis tristis</i>	95.5	73	84
American robin	<i>Turdus migratorius</i>	87	-	87
Bank swallow	<i>Riparia riparia</i>	-	99	99
Barn swallow	<i>Hirundo rustica</i>	95.2	94	95
Cedar waxwing	<i>Bombycilla cedrorum</i>	92.1	67	80
Chipping sparrow	<i>Spizella passerina</i>	86	81	84
Mourning dove	<i>Zenaida macroura</i>	-	70	70

- indicates that value was not reported

**Table D6. FOF Values for Commonly Observed Species of Birds in Ontario Apple Orchards in 1988 (Boutin et al., 1996).**

Species (common name)	Species (scientific name)	FOF (%)				Average
		May	June	July	Aug-Sep	
American crow	<i>Corvus brachyrhynchos</i>	76	68	80	72	74
American goldfinch	<i>Carduelis tristis</i>	-	-	83	75	79
American robin	<i>Turdus migratorius</i>	86	72	73	69	75
Bank swallow	<i>Riparia riparia</i>	-	-	-	72	72
Barn swallow	<i>Hirundo rustica</i>	93.6	100	100	100	98
Blue jay	<i>Cyanocitta cristata</i>	67	-	-	-	67
Brown-headed cowbird	<i>Molothrus ater</i>	73	80	-	-	77
Chipping sparrow	<i>Spizella passerina</i>	75	75	75	87	78
Eastern bluebird	<i>Sialia sialis</i>	-	79	-	-	79
European starling	<i>Sturnus vulgaris</i>	78	86	-	-	82
Mourning dove	<i>Zenaida macroura</i>	-	65	-	80	73
Savannah sparrow	<i>Passerculus sandwichensis</i>	90.5	83	-	-	87

Song sparrow	<i>Melospiza melodia</i>	47	47	-	-	47
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- indicates that value was not reported

### D.2.3. Cabbage in Wisconsin

A census was conducted on birds using cabbage fields and adjacent edge habitats located in Outagamie County, Wisconsin. Census data were collected for 11 weeks during the summer of 1988 (June 10-August 24). The study involved surveys of 12 different fields, ranging in size from 18 to 60 acres. A total of 83 species were observed in the fields or their adjacent habitats (MRID 41585001). For this analysis, “commonly” observed is defined as the average of at least 5 individual birds observed per week, when considering all study sites. The most commonly observed species, the average # of birds observed each week (on all study fields and their adjacent habitats) and the FOF values are provided in **Table D7**.

**Table D7. Commonly Observed Species of Birds in Wisconsin Cabbage Fields during Summer 1988 (MRID 41585001).**

Species (common name)	Species (scientific name)	Average # birds observed/ week	FOF (%)
American crow	<i>Corvus brachyrhynchos</i>	5	3
American goldfinch	<i>Carduelis tristis</i>	16	2
American robin	<i>Turdus migratorius</i>	38	22
Barn swallow	<i>Hirundo rustica</i>	16	1
Black-capped chickadee	<i>Poecile atricapillus</i>	5	0
Blue jay	<i>Cyanocitta cristata</i>	15	4
Brown-headed cowbird	<i>Molothrus ater</i>	10	6
Cedar waxwing	<i>Bombycilla cedrorum</i>	7	0
Cliff swallow	<i>Petrochelidon pyrrhonota</i>	7	53
Common grackle	<i>Quiscalus quiscula</i>	8	11
Common yellowthroat	<i>Geothlypis trichas</i>	9	0
Eastern wood-pewee	<i>Contopus virens</i>	10	1
Great-crested flycatcher	<i>Myiarchus crinitus</i>	6	0
Gray catbird	<i>Dumetella carolinensis</i>	18	3
Indigo bunting	<i>Passerina cyanea</i>	6	1
Killdeer	<i>Charadrius vociferus</i>	6	88
Northern flicker	<i>Colaptes auratus</i>	6	7
Red-winged blackbird	<i>Agelaius phoeniceus</i>	14	1
Rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>	5	0
Savannah sparrow	<i>Passerculus sandwichensis</i>	7	17
Song sparrow	<i>Melospiza melodia</i>	85	7
Tree swallow	<i>Tachycineta bicolor</i>	16	0
White-breasted nuthatch	<i>Sitta carolinensis</i>	6	0

### D.2.4. Citrus in California

MRID 43730301 included a census of birds using citrus (*i.e.*, oranges, lemons, tangerines, grapefruit, limes) orchards and adjacent edge habitats located in Tulare County, California. Census

data were collected for 14 weeks during the spring and summer of 1992 (April 12-July 12). The study involved surveys of 12 different orchards, ranging in size from 19 to 82 acres. A total of 75 species were observed in the orchards or their adjacent habitats. For this analysis, “commonly” observed is defined as the average of at least 5 individual birds observed per week, when considering all study sites. The most commonly observed species, the average # of birds observed each week (on all study fields and their adjacent habitats) and the FOF values are provided in **Table D8**.

**Table D8. Commonly Observed Species of Birds in California Citrus Groves during Spring-Summer 1992 (MRID 43730301).**

Species (common name)	Species (scientific name)	Average # birds observed/ week	FOF (%)
American robin	<i>Turdus migratorius</i>	9	41
Ash-throated flycatcher	<i>Myiarchus cinerascens</i>	9	23
Brewer's blackbird	<i>Euphagus cyanocephalus</i>	26	40
Brown towhee	<i>Pipilo fuscus</i>	17	49
Brown-headed cowbird	<i>Molothrus ater</i>	20	39
Bushtit	<i>Psaltriparus minimus</i>	5	34
California quail	<i>Callipepla californica</i>	23	34
European starling	<i>Sturnus vulgaris</i>	22	14
House finch	<i>Carpodacus mexicanus</i>	50	32
Mourning dove	<i>Zenaida macroura</i>	29	52
Northern mockingbird	<i>Mimus polyglottos</i>	13	35
Red-winged blackbird	<i>Agelaius phoeniceus</i>	11	3
Scrub jay	<i>Aphelocoma coerulescens</i>	92	55
Western kingbird	<i>Tyrannus verticalis</i>	16	13

**D.2.5. Corn in the Midwest US, Southwest US, Florida and Ontario**

Several avian census studies conducted in corn fields and their adjacent habitats are available in the scientific literature and from registrant submissions. This section describes avian census studies that were conducted during the summer months of the 1980s and 1990s in Florida, Illinois, Iowa, Ontario, Texas, New Mexico and Nebraska (**Table D9**).

**Table D9. Locations, Dates and Total Number of Avian Species Observed during Avian Census Studies Involving Corn Fields and Their Adjacent Habitats.**

Study location	Date	Total # species	Source (MRID)
Florida (Wikewa Springs Co.)	1986	17	MRID 40149501
Iowa (Story and Boone Cos.)	1986	53	Best et al. 1990
Illinois (Greene Co)	1986	53	Best et al. 1990
Illinois (Greene Co.)	1990	87	MRID 41742701
Nebraska (Buffalo and Dawson Cos.)	1988	81	MRID 41110601
Ontario (Essex, Niagara and Norfolk Cos.)	1987, 1988	124	Boutin et al. 1996
Texas (Willacy Co.)	1986	91	MRID 40149501
Texas (Dallam Co.) and New Mexico (Union Co.)	1988	50	MRID 41110601

In summer 1986 (May 6-July 9), Best et al. (1990) conducted a study that evaluated the propensity of birds to use cornfields in Illinois and in Iowa. The Illinois portion of the study involved 9 corn fields (sized 20-42 A) located in Greene County. The Iowa portion of the study involved 9 corn fields (sized 27-72 A) that were located in Story and Boone Counties. The census results were reported as average # individuals of a species observed per census in 100 ha. These values were converted to average # of birds observed per week per ha by multiplying the reported values by the total # of censuses (216 for IA and 234 for IL) and dividing by 4 weeks and by 100 ha. For this analysis, “commonly” observed is defined as those that were observed during the study >1 individual per week per ha. The most commonly observed species, the average # of birds observed each week per ha and the FOF values for the Iowa and Illinois studies are provided in **Tables D10 and D11**, respectively.

**Table D10. Commonly Observed Species of Birds in Iowa Corn Fields during Summer 1986 (Best et al., 1990).**

Species (common name)	Species (scientific name)	Average # individuals/ week (per 1 ha)	FOF (%)
American goldfinch	<i>Carduelis tristis</i>	6	14
American robin	<i>Turdus migratorius</i>	8	36
Barn swallow	<i>Hirundo rustica</i>	13	18
Brown thrasher	<i>Toxostoma rufum</i>	2	53
Brown-headed cowbird	<i>Molothrus ater</i>	51	19
Chipping sparrow	<i>Spizella passerina</i>	6	34
Common grackle	<i>Quiscalus quiscula</i>	5	24
Common yellowthroat	<i>Geothlypis trichas</i>	6	23
Dickcissel	<i>Spiza americana</i>	13	16
Eastern kingbird	<i>Tyrannus tyrannus</i>	3	38
European starling	<i>Sturnus vulgaris</i>	3	34
Field sparrow	<i>Spizella pusilla</i>	1	100
Grasshopper sparrow	<i>Ammodramus savannarum</i>	3	15
Gray partridge	<i>Perdix perdix</i>	3	35
House sparrow	<i>Passer domesticus</i>	9	24
Indigo bunting	<i>Passerina cyanea</i>	13	28
Killdeer	<i>Charadrius vociferus</i>	5	100
Mourning dove	<i>Zenaida macroura</i>	7	31
Northern flicker	<i>Colaptes auratus</i>	1	0
Red-winged blackbird	<i>Agelaius phoeniceus</i>	67	17
Savannah sparrow	<i>Passerculus sandwichensis</i>	18	14
Sedge wren	<i>Cistothorus platensis</i>	2	0
Song sparrow	<i>Melospiza melodia</i>	2	100
Vesper sparrow	<i>Pooecetes gramineus</i>	22	40
Western meadowlark	<i>Sturnella neglecta</i>	3	9

**Table D11. Commonly Observed Species of Birds in Illinois Corn Fields during Summer 1986 (Best et al., 1990).**

Species (common name)	Species (scientific name)	Average # individuals/ week (per 1 ha)	FOF (%)
American crow	<i>Corvus brachyrhynchos</i>	6	6
American goldfinch	<i>Carduelis tristis</i>	80	2
American robin	<i>Turdus migratorius</i>	73	16
Black-capped chickadee	<i>Poecile atricapillus</i>	80	0
Blue jay	<i>Cyanocitta cristata</i>	61	1
Brown thrasher	<i>Toxostoma rufum</i>	13	1
Brown-headed cowbird	<i>Molothrus ater</i>	82	15
Cedar waxwing	<i>Bombycilla cedrorum</i>	3	0
Common grackle	<i>Quiscalus quiscula</i>	52	12
Common yellowthroat	<i>Geothlypis trichas</i>	116	0
Downy woodpecker	<i>Picoides pubescens</i>	25	2
Eastern kingbird	<i>Tyrannus tyrannus</i>	3	43
Eastern phoebe	<i>Sayornis phoebe</i>	2	0
Eastern wood-pewee	<i>Contopus virens</i>	7	0
Eurasian tree sparrow	<i>Passer montanus</i>	2	0
European starling	<i>Sturnus vulgaris</i>	5	3
Field sparrow	<i>Spizella pusilla</i>	3	3
Gray catbird	<i>Dumetella carolinensis</i>	32	0
Great-crested flycatcher	<i>Myiarchus crinitus</i>	14	0
Green-backed heron	<i>Butorides striatus</i>	4	0
Horned lark	<i>Eremophila alpestris</i>	8	86
House wren	<i>Troglodytes aedon</i>	3	24
House wren	<i>Troglodytes aedon</i>	85	0
Indigo bunting	<i>Passerina cyanea</i>	465	1
Mourning dove	<i>Zenaida macroura</i>	12	14
Northern bobwhite	<i>Colinus virginianus</i>	23	1
Northern cardinal	<i>Cardinalis cardinalis</i>	68	3
Northern flicker	<i>Colaptes auratus</i>	33	1
Northern oriole	<i>Icterus galbula</i>	40	1
Orchard oriole	<i>Icterus spurius</i>	2	0
Pileated woodpecker	<i>Dryocopus pileatus</i>	3	0
Red-bellied woodpecker	<i>Melanerpes carolinus</i>	27	1
Red-eyed vireo	<i>Vireo olivaceus</i>	1	0
Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>	52	8
Red-winged blackbird	<i>Agelaius phoeniceus</i>	231	7
Rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>	6	0

Song sparrow	<i>Melospiza melodia</i>	13	5
Tennessee warbler	<i>Vermivora peregrina</i>	1	0
Tufted titmouse	<i>Baeolophus bicolor</i>	72	0
Vesper sparrow	<i>Poocetes gramineus</i>	1	13
White-breasted nuthatch	<i>Sitta carolinensis</i>	7	0
white-crowned sparrow	<i>Zonotrichia leucophrys</i>	1	48
willow flycatcher	<i>Empidonax trailii</i>	5	0
Yellow warbler	<i>Dendroica petechia</i>	7	0
Yellow-breasted chat	<i>Icteria virens</i>	14	0

MRID 41742701 included a census of birds using corn fields and adjacent edge habitats located in Greene County of Illinois. Census data were collected for 4 weeks during the summer (May 5-July 3) of 1990. The study involved surveys of 16 different fields ranging in size from 13 to 42 acres. A total of 87 species were observed in the fields or their adjacent habitats. For this analysis, “commonly” observed is defined as the average of at least 5 individual birds observed per week, when considering all study sites. The most commonly observed species, the average # of birds observed each week (on all study fields and their adjacent habitats) and the FOF values are provided in **Table D12**.

**Table D12. Commonly Observed Species of Birds in Illinois Corn Fields during Summer 1990 (MRID 41742701).**

Species (common name)	Species (scientific name)	Average # birds observed/ week	FOF (%)
American goldfinch	<i>Carduelis tristis</i>	21	38
American robin	<i>Turdus migratorius</i>	61	38
Barn swallow	<i>Hirundo rustica</i>	5	62
Black-capped chickadee	<i>Poecile atricapillus</i>	25	8
Blue jay	<i>Cyanocitta cristata</i>	65	33
Brown thrasher	<i>Toxostoma rufum</i>	35	43
Brown-headed cowbird	<i>Molothrus ater</i>	110	60
Canada goose	<i>Branta canadensis</i>	9	100
Cedar waxwing	<i>Bombycilla cedrorum</i>	64	8
Common grackle	<i>Quiscalus quiscula</i>	150	44
Common yellowthroat	<i>Geothlypis trichas</i>	16	17
Downy woodpecker	<i>Picoides pubescens</i>	10	7
Eastern bluebird	<i>Sialia sialis</i>	17	76
Eastern kingbird	<i>Tyrannus tyrannus</i>	30	45
Eastern meadowlark	<i>Sturnella magna</i>	10	89
Eastern wood pewee	<i>Contopus virens</i>	7	3
European starling	<i>Sturnus vulgaris</i>	10	51
Field sparrow	<i>Spizella pusilla</i>	14	11
Gray catbird	<i>Dumetella carolinensis</i>	23	16
Great-crested flycatcher	<i>Myiarchus crinitus</i>	13	4
Horned lark	<i>Eremophila alpestris</i>	42	82
House wren	<i>Troglodytes aedon</i>	6	0
Indigo bunting	<i>Passerina cyanea</i>	146	30
Killdeer	<i>Charadrius vociferus</i>	8	97

Mourning dove	<i>Zenaida macroura</i>	20	33
Northern bobwhite	<i>Colinus virginianus</i>	9	53
Northern cardinal	<i>Cardinalis cardinalis</i>	111	34
Northern flicker	<i>Colaptes auratus</i>	12	29
Northern oriole	<i>Icterus galbula</i>	30	11
Orchard oriole	<i>Icterus spurius</i>	5	0
Red-bellied woodpecker	<i>Melanerpes carolinus</i>	19	18
Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>	41	50
Red-winged blackbird	<i>Agelaius phoeniceus</i>	156	58
Rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>	8	6
Song sparrow	<i>Melospiza melodia</i>	15	27
Swainson's thrush	<i>Catharus ustulatus</i>	5	20
Tufted titmouse	<i>Baeolophus bicolor</i>	21	4
Western palm warbler	<i>Dendroica palmarum</i>	11	16
Yellow warbler	<i>Dendroica petechia</i>	10	0
Yellow-rumped (magnolia) warbler	<i>Dendroica magnolia</i>	8	9

In July – September, 1987 and in May – September 1988, cornfields and their edge habitats located in 3 counties in Southern Ontario (Essex, Niagara and Norfolk Counties) were surveyed for birds (Boutin et al., 1996). The study authors defined commonly observed species as those that were observed in the field or edge habitat more than 50% of the observation periods. During the two summers, 14 species were commonly observed. Mean percent of individuals within each of these species observed within the cornfields in 1987 and in 1988 are provided in **Tables D13 and D14**, respectively. These values are representative of frequency on field for different species during different months. The commonly observed species and their frequency on field values varied from month to month.

**Table D13. FOF Values for Commonly Observed Species of Birds in Ontario Corn Fields in 1987 (Boutin et al., 1996).**

Species (common name)	Species (scientific name)	FOF (%)		
		July 1987	Aug-Sep 1987	Average
American goldfinch	<i>Carduelis tristis</i>	39	39	39
American robin	<i>Turdus migratorius</i>	38	42	40
Barn swallow	<i>Hirundo rustica</i>	93	-	93
House sparrow	<i>Passer domesticus</i>	-	48	48
Indigo bunting	<i>Passerina cyanea</i>	22	-	22
Red-winged blackbird	<i>Agelaius phoeniceus</i>	63	-	63
Song sparrow	<i>Melospiza melodia</i>	35	29	32

- indicates that value was not reported

**Table D14. FOF Values for Commonly Observed Species of Birds in Ontario Corn Fields in 1988 (Boutin et al., 1996).**

Species (common name)	Species (scientific name)	FOF (%)				
		May	June	July	Aug-Sep	Average
American goldfinch	<i>Carduelis tristis</i>	-	-	-	21	21
American robin	<i>Turdus migratorius</i>	41	25	29	22	29
Barn swallow	<i>Hirundo rustica</i>	99.5	96.2	95.3	98.8	97
Brown-headed cowbird	<i>Molothrus ater</i>	34	19	-	-	27
Common grackle	<i>Quiscalus quiscula</i>	59	42	-	-	51
European starling	<i>Sturnus vulgaris</i>	52	23	-	12	29
Horned lark	<i>Eremophila alpestris</i>	93.4	84	72	-	83
House sparrow	<i>Passer domesticus</i>	-	-	25	-	25
Indigo bunting	<i>Passerina cyanea</i>	-	-	14	-	14
Killdeer	<i>Charadrius vociferus</i>	78	-	-	-	78
Mourning dove	<i>Zenaida macroura</i>	-	-	-	31	31
Red-winged blackbird	<i>Agelaius phoeniceus</i>	34	23	52	70	45
Song sparrow	<i>Melospiza melodia</i>	4	4	17	70	24
Yellow warbler	<i>Dendroica petechia</i>	0	-	-	-	0

- indicates that value was not reported

MRID 40149501 included a census of birds using corn fields and adjacent edge habitats located in Texas. Avian censuses were conducted during the summer and fall of 1986 on 9 study fields. In this census, 91 species were observed. For the current analysis, “commonly” observed species are defined as those that were observed at least 100 times, which is equivalent to at least 1% of the total number of observed birds. The commonly observed species on the fields and their FOF values are provided in **Table D15**.

**Table D15. Commonly Observed Species of Birds in Texas Corn Fields during Fall 1986 (MRID 40149501).**

Species (common name)	Species (scientific name)	Total # birds observed during study	FOF (%)
Barn swallow	<i>Hirundo rustica</i>	176	29%
Black-necked stilt	<i>Himantopus mexicanus</i>	112	33%
Blue-winged teal	<i>Anas discors</i>	311	65%
Brown-headed cowbird	<i>Molothrus ater</i>	144	33%
Great-tailed grackle	<i>Quiscalus mexicanus</i>	4415	35%
House sparrow	<i>Passer domesticus</i>	203	63%
Least sandpiper	<i>Calidris minutilla</i>	132	1%
Long-billed dowitcher	<i>Limnodromus scolopaceus</i>	1025	10%
Mourning dove	<i>Zenaida macroura</i>	657	61%
Northern bobwhite	<i>Colinus virginianus</i>	100	22%
Red-winged blackbird	<i>Agelaius phoeniceus</i>	1298	62%
White-faced ibis	<i>Plegadis chihi</i>	104	96%

MRID 41110601 included a census of birds using corn fields and adjacent edge habitats located in Texas and New Mexico. Data were reported for 5 weeks during the summer of 1988 (July 26 – August 6). The study involved surveys of 16 different study fields. During the census, 50 avian species were identified in the corn fields and edge habitats. For the current analysis, “commonly” observed species are defined as those that were observed an average of at least 10 times per week on at least one study field. The commonly observed species on the fields and their FOF values (range and average) are provided in **Table D16**.

**Table D16. Commonly Observed Species of Birds in Texas and New Mexico Corn Fields during Summer of 1988 (MRID 41110601).**

Species (common name)	Species (scientific name)	# fields*	Average # observations/10 ha per field per week	FOF Range (%)	Average FOF** (%)
Bank swallow	<i>Riparia riparia</i>	10	10-813	90-100	97
Brewer’s blackbird	<i>Euphagus cyanocephalus</i>	1	14	0	0
Brown-headed cowbird	<i>Molothrus ater</i>	1	56	100	100
Chipping sparrow	<i>Spizella passerina</i>	1	27	88	88
Cliff swallow	<i>Petrochelidon pyrrhonota</i>	15	14-268	87-100	96
Common nighthawk	<i>Chordeiles minor</i>	1	36	98	98
Dickcissel	<i>Spiza americana</i>	1	11	100	100
Horned lark	<i>Eremophila alpestris</i>	1	18	61	61
Lark bunting	<i>Calamospiza melanocorys</i>	6	14-49	0-40	7
Lark sparrow	<i>Chondestes grammacus</i>	2	11-79	72-85	79
Mourning dove	<i>Zenaida macroura</i>	1	19	0	0
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	1	20	98	98
Red-winged blackbird	<i>Agelaius phoeniceus</i>	11	10-283	38-100	89
Western kingbird	<i>Tyrannus verticalis</i>	1	14	92	92
Western meadowlark	<i>Sturnella neglecta</i>	1	10	0	0
Yellow-headed blackbird	<i>Xanthocephalus xanthocephalus</i>	2	18-24	100	100

\* where a bird species was observed  $\geq 10$  times on average/10 ha/week

\*\*over all study fields

MRID 41110601 also included a census of birds using corn fields and adjacent edge habitats located in Nebraska. Data were reported for 5 weeks during the summer of 1988 (July 11 – August 27). The study involved surveys of 15 different corn fields and their edge habitats. During the census, 81 avian species were identified in the corn fields and edge habitats. For the current analysis, “commonly” observed species are defined as those that were observed an average of at least 10 times per week on at least one study field. The commonly observed species on the fields and their FOF values (range and average) are provided in **Table D17**.

**Table D17. Commonly Observed Species of Birds in Nebraska Corn Fields during Summer of 1988 (MRID 41110601).**

Species (common name)	Species (scientific name)	Number of fields*	Average # observations/10 ha per field per week	FOF Range (%)	Average FOF** (%)
American goldfinch	<i>Carduelis tristis</i>	7	10-31	0-63	32
American robin	<i>Turdus migratorius</i>	10	11-197	0-72	21
Bank swallow	<i>Riparia riparia</i>	4	10-24	0-84	34
Black-capped chickadee	<i>Poecile atricapillus</i>	14	16-121	17-83	48
Blue jay	<i>Cyanocitta cristata</i>	14	10-108	0-79	22
Brown thrasher	<i>Toxostoma rufum</i>	10	12-49	0-73	35
Chimney swift	<i>Chaetura pelagica</i>	4	10-168	57-93	75
Chipping sparrow	<i>Spizella passerina</i>	6	12-78	0-84	35
Cliff swallow	<i>Petrochelidon pyrrhonota</i>	3	10-12	100	100
Common grackle	<i>Quiscalus quiscula</i>	6	10-69	0-100	24
Common yellowthroat	<i>Geothlypis trichas</i>	3	10-15	0-100	46
Dickcissel	<i>Spiza americana</i>	3	10-49	27-46	40
Downy woodpecker	<i>Picoides pubescens</i>	1	16	51	51
Eastern kingbird	<i>Tyrannus</i>	15	16-87	0-71	37
Field sparrow	<i>Spizella pusilla</i>	1	12	46	46
Gray catbird	<i>Dumetella carolinensis</i>	4	10-26	0-68	28
House sparrow	<i>Passer domesticus</i>	4	32-133	0-90	26
House wren	<i>Troglodytes aedon</i>	14	16-67	0-61	22
Indigo bunting	<i>Passerina cyanea</i>	1	15	44	44
Mourning dove	<i>Zenaida macroura</i>	13	10-59	0-32	5
Northern cardinal	<i>Cardinalis</i>	1	20	68	68
Northern flicker	<i>Colaptes auratus</i>	7	12-19	0-13	3
Northern oriole	<i>Icterus galbula</i>	15	12-60	10-55	34
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	5	11-32	27-100	85
Orchard oriole	<i>Icterus spurius</i>	3	10-12	0-41	18
Purple martin	<i>Progne subis</i>	1	22	100	100
Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>	11	13-49	0-62	17
Red-winged blackbird	<i>Agelaius phoeniceus</i>	2	15-17	0-42	21
Western kingbird	<i>Tyrannus verticalis</i>	2	10-30	0-83	41
Yellow warbler	<i>Dendroica petechia</i>	1	11	29	29

\* where the species was observed  $\geq 10$  times on average/10 ha/week

\*\*over all study fields

MRID 40149501 included a census of birds using corn fields and adjacent edge habitats located in Florida. Avian censuses were conducted during the summer and fall of 1986 on 9 study fields. In this census, 18 species were observed. For the current analysis, “commonly” observed species are defined as those that were observed at least 25 times, which is equivalent to at least 5% of the total number of observed birds. The commonly observed species on the fields and their FOF values are provided in **Table D18**.

**Table D18. Commonly Observed Species of Birds in Texas Corn Fields during Fall 1986 (MRID 40149501).**

Species (common name)	Species (scientific name)	Total # birds observed during study	FOF (%)
Boat-tailed grackle	<i>Quiscalus major</i>	35	68
Cattle egret	<i>Bubulcus ibis</i>	28	100
Common grackle	<i>Quiscalus quiscula</i>	116	97
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	70	99

### D.2.6. Cotton in the Southern United States

Several avian census studies of cotton fields and their adjacent habitats were submitted by pesticide registrants (MRIDs 41548803, 43492814 and 44464202). These studies involved fields located in Alabama, Mississippi, Arizona and Texas (**Table D19**). Each study involved 12 different fields that were monitored for several weeks in the summers of 1988, 1993 or 1995. The total number of species observed in these ranged 47-65; however, the majority of the species were observed infrequently (*i.e.*, <2 individual per field over the entire study period). For this analysis, “commonly” observed is defined as the average of at least 5 individual birds observed per week, when considering all study sites. **Tables D20, D21 and D22** present the average # of birds observed per week (on all study fields and their adjacent habitats) and the FOF values for the commonly observed species in the studies conducted in Alabama and Mississippi, Arizona and Texas, respectively. Note that the commonly observed species differ by location and by year; however, several species were commonly observed in two or three of the study sites (*e.g.*, horned lark, red-winged blackbird).

**Table D19. Locations, Dates and Total # of Avian Species Observed during Avian Census Studies Involving Cotton Fields and Their Adjacent Habitats.**

Study location	Date	Total # species	Source (MRID)
Alabama (Lee and Macon Cos.)	1988	48	41548803
Alabama (Lee and Macon Cos.) and Mississippi (Leflore Co.)	1993	65	43492814
Alabama (Lee and Macon Cos.) and Mississippi (Leflore Co.)	1995	54	44464202
Arizona (La Paz and Yuma Cos.)	1993	51	43492814
Arizona (La Paz and Yuma Cos.)	1995	54	44464202
Texas (Tom Green and Dawson Cos.)	1993	62	43492814
Texas (Burlleson, Williamson and Milam Cos)	1995	47	44464202

**Table D20. Frequency on Field (FOF) Values of Commonly Observed Avian Species during Cotton Census Studies Conducted in Alabama and Mississippi during Summers of 1988, 1993 and 1995.**

Species (common name)	Species (scientific name)	Average # birds observed/ week			FOF (%)		
		1988*	1993**	1995***	1988*	1993**	1995***
Blue jay	<i>Cyanocitta cristata</i>	-	21	29	-	1	2
Blue-gray gnatcatcher	<i>Poliophtila caerulea</i>	-	6	10	-	-	1
Carolina chickadee	<i>Poecile carolinensis</i>	16	19	25	1	0	8
Carolina wren	<i>Thryothorus ludovicianus</i>	15	19	22	1	1	1
Chimney swift	<i>Chaetura pelagica</i>	-	-	22	-	-	70
Common grackle	<i>Quiscalus quiscula</i>	-	8	-	-	33	-
Downy woodpecker	<i>Picoides pubescens</i>	-	5	7	-	-	0
Horned lark	<i>Eremophila alpestris</i>	-	35	-	-	68	-
Indigo bunting	<i>Passerina cyanea</i>	23	33	34	9	13	34
Mourning dove	<i>Zenaida macroura</i>	-	-	10	-	-	8
Northern bobwhite	<i>Colinus virginianus</i>	6	-	-	3	-	-
Northern cardinal	<i>Cardinalis cardinalis</i>	40	53	81	17	11	19
Red-bellied woodpecker	<i>Melanerpes carolinus</i>	-	8	15	-	0	0
Red-winged blackbird	<i>Agelaius phoeniceus</i>	-	39	-	-	53	-
Ruby-throated hummingbird	<i>Archilochus colubris</i>	17	12	19	42	34	58
Rufous-sided towhee	<i>Pipilo erythrophthalmus</i>	18	5	-	1	-	-
Tufted titmouse	<i>Baeolophus bicolor</i>	-	7	11	-	0	0
White-eyed vireo	<i>Vireo griseus</i>	-	11	-	-	0	-
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	-	12	8	-	0	5

\* This study (MRID 41548803) was conducted in Alabama only.

\*\*MRID 43492814

\*\*\*MRID 44464202

**Table D21. Frequency on Field (FOF) Values of Commonly Observed Avian Species during Cotton Census Studies Conducted in Arizona during Summers of 1993 and 1995.**

Species (common name)	Species (scientific name)	Average # birds observed/ week		FOF (%)	
		1993*	1995**	1993*	1995**
Abert's towhee	<i>Pipilo aberti</i>	39	48	39	50
Black-throated sparrow	<i>Amphispiza bilineata</i>	24	-	37	-
Blue grosbeak	<i>Guiraca caerulea</i>	6	10	-	29
Brown-headed cowbird	<i>Molothrus ater</i>	8	29	-	34
Cliff swallow	<i>Petrochelidon pyrrhonota</i>	47	48	62	99
Common moorhen	<i>Gallinula chloropus</i>	9	-	0	-
Common yellowthroat	<i>Geothlypis trichas</i>	12	28	14	37
Gambel's quail	<i>Callipepla gambelii</i>	38	20	31	27
House finch	<i>Carpodacus mexicanus</i>	-	5	-	2
Horned lark	<i>Eremophila alpestris</i>	22	-	36	-
Lesser nighthawk	<i>Chordeiles acutipennis</i>	7	-	63	-
Loggerhead shrike	<i>Lanius ludovicianus</i>	9	-	17	-
Lark sparrow	<i>Chondestes grammacus</i>	-	28	-	35

Mourning dove	<i>Zenaida macroura</i>	14	17	15	18
Northern oriole	<i>Icterus galbula</i>	5	6	30	68
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	19	-	74	-
Red-winged blackbird	<i>Agelaius phoeniceus</i>	319	321	83	82
Tree swallow	<i>Tachycineta bicolor</i>	9	-	69	-
Verdin	<i>Auriparus flaviceps</i>	-	14	-	57
Violet-green swallow	<i>Tachycineta thalassina</i>	7	-	56	-
Western kingbird	<i>Tyrannus verticalis</i>	6	-	29	-
White-winged dove	<i>Zenaida asiatica</i>	-	16	-	6
Yellow-breasted chat	<i>Icteria virens</i>	-	10	-	2
Yellow-headed blackbird	<i>Xanthocephalus xanthocephalus</i>	138	-	4	-

\*MRID 43492814

\*\*MRID 44464202

**Table D22. Frequency on Field (FOF) Values of Commonly Observed Avian Species during Cotton Census Studies Conducted in Texas during Summers of 1993 and 1995.**

Species (common name)	Species (scientific name)	Average # birds observed/ week		FOF (%)	
		1993*	1995**	1993*	1995**
Barn swallow	<i>Hirundo rustica</i>	13	11	68	73
Brown-headed cowbird	<i>Molothrus ater</i>	-	9	-	19
Cactus wren	<i>Campylorhynchus brunneicapillus</i>	9	-	0	-
Carolina chickadee	<i>Poecile carolinensis</i>	-	13	-	2
Carolina wren	<i>Thryothorus ludovicianus</i>	-	10	-	0
Cassin's sparrow	<i>Aimophila cassinii</i>	12	-	7	-
Cliff swallow	<i>Petrochelidon pyrrhonota</i>	24	-	72	-
Dickcissel	<i>Spiza americana</i>	-	5	-	72
Horned lark	<i>Eremophila alpestris</i>	26	-	57	-
House finch	<i>Carpodacus mexicanus</i>	5	-	3	-
Indigo bunting	<i>Passerina cyanea</i>	-	8	-	24
Lark sparrow	<i>Chondestes grammacus</i>	14	6	33	44
Mourning dove	<i>Zenaida macroura</i>	9	9	5	21
Northern bobwhite	<i>Colinus virginianus</i>	10	-	1	-
Northern cardinal	<i>Cardinalis cardinalis</i>	12	39	1	21
Northern mockingbird	<i>Mimus polyglottos</i>	20	7	4	5
Northern oriole	<i>Icterus galbula</i>	14	-	5	-
Painted bunting	<i>Passerina ciris</i>	-	11	-	28
Pyrrhuloxia	<i>Cardinalis sinuatus</i>	9	-	0	-
Red-winged blackbird	<i>Agelaius phoeniceus</i>	15	-	35	-
Scaled quail	<i>Callipepla squamata</i>	5	-	0	-
Scissor-tailed flycatcher	<i>Tyrannus forficatus</i>	11	-	19	-
White-eyed vireo	<i>Vireo griseus</i>	-	7	-	2
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	5	7	6	2

\*MRID 43492814

\*\*MRID 44464202

### D.2.7. Grapes in Southern Ontario

In July – September 1987, grape vineyards and their edge habitats located in Niagara County in Southern Ontario were surveyed for birds (Boutin et al., 1996). The study authors defined commonly observed species as those that were observed in the field or edge habitat more than 50% of the observation periods. During the study, 8 species were commonly observed. Mean percent of individuals within each of these species observed within the grape vineyards are provided in **Table D23**. These values are representative of FOF for different species during different months. The commonly observed species and their frequency on field values varied from month to month.

**Table D23. FOF Values for Commonly Observed Species of Birds in Ontario Grape Vineyards in 1987 (Boutin et al., 1996).**

Species (common name)	Species (scientific name)	FOF (%)		
		July	Aug-Sep	Average
American goldfinch	<i>Carduelis tristis</i>	88	64	76
American robin	<i>Turdus migratorius</i>	85	68	77
Chipping sparrow	<i>Spizella passerina</i>	84	75	80
Eastern kingbird	<i>Tyrannus tyrannus</i>	20	-	20
Killdeer	<i>Charadrius vociferus</i>	65	-	65
Red-winged blackbird	<i>Agelaius phoeniceus</i>	86	-	86
Savannah sparrow	<i>Passerculus sandwichensis</i>	82	-	82
Song sparrow	<i>Melospiza melodia</i>	58	-	58

- indicates that value was not reported

### D.2.8. Potatoes in New Jersey

MRID 42333001 included a census of birds using potato fields and adjacent edge habitats located in Salem, Cumberland and Atlantic counties of New Jersey. Census data were collected for 7 weeks during the summer of 1990 (May 22 - July 9). The study involved surveys of 12 different fields ranging in size from 16 to 65 acres. A total of 127 species were observed in the fields or their adjacent habitats. For this analysis, “commonly” observed is defined as the average of at least 5 individual birds observed per week, when considering all study sites. The most commonly observed species, the average # of birds observed each week (on all study fields and their adjacent habitats) and the FOF values are provided in **Table D24**.

**Table D24. Commonly Observed Species of Birds in New Jersey Potato Fields during Summer 1990 (MRID 42333001).**

Species (common name)	Species (scientific name)	Average # birds observed/ week	FOF (%)
American crow	<i>Corvus brachyrhynchos</i>	14	12
American goldfinch	<i>Carduelis tristis</i>	6	13
American robin	<i>Turdus migratorius</i>	51	20
Barn swallow	<i>Hirundo rustica</i>	12	91
Blue jay	<i>Cyanocitta cristata</i>	42	3
Brown-headed cowbird	<i>Molothrus ater</i>	5	3
Brown thrasher	<i>Toxostoma rufum</i>	6	39
Carolina chickadee	<i>Poecile carolinensis</i>	18	0
Carolina wren	<i>Thryothorus ludovicianus</i>	23	0
Chimney swift	<i>Chaetura pelagica</i>	6	98
Common grackle	<i>Quiscalus quiscula</i>	44	17
Common yellowthroat	<i>Geothlypis trichas</i>	63	2
Downy woodpecker	<i>Picoides pubescens</i>	10	0
Eastern wood-pewee	<i>Contopus virens</i>	18	0
European starling	<i>Sturnus vulgaris</i>	6	39
Gray catbird	<i>Dumetella carolinensis</i>	135	12
Great-crested flycatcher	<i>Myiarchus crinitus</i>	16	0
House wren	<i>Troglodytes aedon</i>	14	0
Indigo bunting	<i>Passerina cyanea</i>	66	6
Mourning dove	<i>Zenaida macroura</i>	29	7
Northern bobwhite	<i>Colinus virginianus</i>	10	7
Northern cardinal	<i>Cardinalis cardinalis</i>	60	3
Northern flicker	<i>Colaptes auratus</i>	15	0
Northern mockingbird	<i>Mimus polyglottos</i>	6	5
Ovenbird	<i>Seiurus aurocapillus</i>	21	0
Red-bellied woodpecker	<i>Melanerpes carolinus</i>	28	0
Red-eyed vireo	<i>Vireo olivaceus</i>	15	1
Red-winged blackbird	<i>Agelaius phoeniceus</i>	23	3
Rufous-sided towhee	<i>Pipilo erithrophthalmus</i>	17	6
Scarlet tanager	<i>Piranga olivacea</i>	6	0
Song sparrow	<i>Melospiza melodia</i>	33	14
Tufted titmouse	<i>Baeolophus bicolor</i>	17	0
White-eyed vireo	<i>Vireo griseus</i>	33	0
Wood thrush	<i>Hylocichla mustelina</i>	46	1
Yellow warbler	<i>Dendroica petechia</i>	10	0

### D.2.9. Soybeans in Southern Ontario

In July – September 1987 and in May – September 1988, soybean fields and their edge habitats located in Essex County in Southern Ontario were surveyed for birds (Boutin et al., 1996). The study authors defined commonly observed species as those that were observed in the field or edge habitat more than 50% of the observation periods. During the study, 16 species were commonly observed. The mean percent of individuals within each of the species observed within the soybean fields in 1987 and 1988 are provided in **Tables D25 and D26**, respectively. These values are representative of FOF for different species during different months of the summer. The commonly observed species and their frequency on field values varied from month to month.

**Table D25. FOF Values for Commonly Observed Species of Birds in Ontario Soybean Fields in 1987 (Boutin et al., 1996).**

Species (common name)	Species (scientific name)	FOF (%)		
		July	Aug-Sep	Average
American robin	<i>Turdus migratorius</i>	2	-	2
Barn swallow	<i>Hirundo rustica</i>	94.9	96.2	95.6
European starling	<i>Sturnus vulgaris</i>	0	-	0
Horned lark	<i>Eremophila alpestris</i>	60	-	60
House sparrow	<i>Passer domesticus</i>	20	-	20
Indigo bunting	<i>Passerina cyanea</i>	0	-	0
Purple martin	<i>Progne subis</i>	100	-	100
Song sparrow	<i>Melospiza melodia</i>	24	19	22
Vesper sparrow	<i>Pooecetes gramineus</i>	34	-	34

- indicates that the value was not reported

**Table D26. FOF Values for Commonly Observed Species of Birds in Ontario Soybean Fields in 1988 (Boutin et al., 1996).**

Species (common name)	Species (Scientific name)	FOF (%)				
		May	June	July	Aug-Sep	Average
American crow	<i>Corvus brachyrhynchos</i>	50	-	-	-	50
American robin	<i>Turdus migratorius</i>	0	23	27	16	17
Barn swallow	<i>Hirundo rustica</i>	-	100	100	98.2	99
Chipping sparrow	<i>Spizella passerina</i>	0	11	33	-	15
Common grackle	<i>Quiscalus quiscula</i>	34	54	-	-	44
European starling	<i>Sturnus vulgaris</i>	0	-	-	0	0
Horned lark	<i>Eremophila alpestris</i>	97.5	98.1	69	-	88
House sparrow	<i>Passer domesticus</i>	33	7	12	9	15
Indigo bunting	<i>Passerina cyanea</i>	-	-	0	-	0
Killdeer	<i>Charadrius vociferus</i>	69	-	-	-	69
Mourning dove	<i>Zenaida macroura</i>	-	-	-	11	11
Northern cardinal	<i>Cardinalis cardinalis</i>	-	-	-	2	2
Purple martin	<i>Progne subis</i>	-	-	95	-	95

Red-winged blackbird	<i>Agelaius phoeniceus</i>	25	22	-	-	24
Song sparrow	<i>Melospiza melodia</i>	9	4	8	11	8
Vesper sparrow	<i>Poocetes gramineus</i>	62	-	37	-	50

- indicates that the value was not reported

### D.3. Summary of Avian Species Commonly Observed in Agricultural Areas

Based on the field studies summarized above, a total of 117 species of birds have been identified as commonly visiting agricultural fields and their adjacent (edge) habitats. These species are listed in **Table D27**, along with their order, diet and BW from the above studies and crops where the species were commonly observed. Several species were commonly observed in many studies conducted in different crops and geographic locations (*e.g.*, American crow, American robin, barn swallow, blue jay, brown-headed cowbird, chipping sparrow, common grackle, mourning dove, northern cardinal, and red-winged blackbird). On the other hand, several species were commonly observed in only one of the 26 studies described above (*e.g.*, ash-throated flycatcher, blue-gray gnatcatcher, brown towhee, common moorhen, lark bunting, pyrrhuloxia).

#### D.3.1. Taxonomy of Common Species

The majority (89) of the commonly observed species are in the Passeriform order. Species from the Anseriformes (2), Apodiformes (2), Caprimulgiformes (2), Charadiiformes (4), Ciconiiformes (3), Columbiformes (2), Cuculiformes (1), Falconiformes (1), Galliformes (5), Gruiformes (1) and Piciformes (5) orders were also commonly observed on agricultural fields and adjacent habitats of the studies described above (**Table D27**). Within the same order, there are several instances where species fall within the same family or genus (*e.g.*, *Dendroica sp.*, *Pipilo sp.*).

**Table D27. Commonly Observed Species on Agricultural Fields and Associated Edge Habitats. Table includes species-specific diet and body weight data.**

Species (scientific name)	Species (common name)	Order	Predominant diet*	Additional diet items*	Mean body weight (g)**	CV of BW**	BW range (g)**
<i>Agelaius phoeniceus</i>	Red-winged blackbird	Passeriformes	seeds	insects	52.6	0.0678	29.0-81.1
<i>Aimophila cassinii</i>	Cassin's sparrow	Passeriformes	insects, seeds	none	18.9	0.0799	14.0-23.5
<i>Ammodramus savannarum</i>	Grasshopper sparrow	Passeriformes	insects, seeds	none	17	0.162	13.4-28.4
<i>Amphispiza bilineata</i>	Black-throated sparrow	Passeriformes	insects, seeds	none	13.5	0.0852	10.2-16.4
<i>Anas discors</i>	Blue-winged Teal	Anseriformes	seeds, green plant matter	aquatic invertebrates	386	NA	up to 590
<i>Anthus spinoletta</i>	Water pipit	Passeriformes	insects+	seeds+	20.9	NA	18.6-25.5
<i>Aphelocoma coerulescens</i>	Scrub jay	Passeriformes	nuts, seeds	insects, eggs, reptiles, amphibians	84.3	NA	59-112
<i>Archilochus colubris</i>	Ruby-throated hummingbird	Apodiformes	nectar, insects	none	3.2	0.0727	2.4-4.8
<i>Auriparus flaviceps</i>	Verdin	Passeriformes	insects, fruit, seeds	none	6.8	0.101	5.5-8.5
<i>Baeolophus bicolor</i>	Tufted titmouse	Passeriformes	insects	nuts, seeds, fruit	21.6	NA	17.5-26.1
<i>Bombycilla cedrorum</i>	Cedar waxwing	Passeriformes	fruit	insects	31.9	0.0443	25.5-40.2
<i>Branta canadensis</i>	Canada goose	Anseriformes	plant matter	aquatic invertebrates	2943	0.0217	940-6265
<i>Bubulcus ibis</i>	Cattle Egret	Ciconiiformes	insects	none	338	NA	NA
<i>Buteo jamaicensis</i>	Red-tailed hawk	Falconiformes	small mammals	reptiles, amphibians, birds	1126	NA	NA
<i>Butorides striatus</i>	Green-backed heron	Ciconiiformes	N/A	N/A	212	0.0279	NA
<i>Calamospiza melanocorys</i>	Lark bunting	Passeriformes	seeds, insects	none	37.6	0.0973	29.5-51.5
<i>Calidris minutilla</i>	Least Sandpiper	Charadriiformes	aquatic invertebrates	plant matter	20.9	0.0665	18-24
<i>Callipepla californica</i>	California quail	Galliformes	seeds, green plant matter	insects	173	NA	Up to 207
<i>Callipepla gambelii</i>	Gambel's quail	Galliformes	seeds	insects	166	NA	up to 207
<i>Callipepla squamata</i>	Scaled quail	Galliformes	seeds	insects	184	NA	up to 234
<i>Campylorhynchus brunneicapillus</i>	Cactus wren	Passeriformes	insects	fruit	38.9	NA	33.4-46.9
<i>Cardinalis cardinalis</i>	Northern cardinal	Passeriformes	seeds, fruit	insects	44.7	0.0987	33.6-64.9

Species (scientific name)	Species (common name)	Order	Predominant diet*	Additional diet items*	Mean body weight (g)**	CV of BW**	BW range (g)**
<i>Cardinalis sinuatus</i>	Pyrrhuloxia	Passeriformes	seeds	insects	35.5	0.059	29.7-44.0
<i>Carduelis tristis</i>	American goldfinch	Passeriformes	seeds	insects	12.9	0.075	8.6-17.1
<i>Carpodacus mexicanus</i>	House finch	Passeriformes	seeds	insects	21.4	0.0603	19-25.5
<i>Catharus ustulatus</i>	Swainson's thrush	Passeriformes	insects	fruit, worms	30.8	0.0594	21.9-50.7
<i>Chaetura pelagica</i>	Chimney swift	Apodiformes	insects	none	23.6	0.0127	17.0-29.8
<i>Charadrius vociferus</i>	Killdeer	Charadriiformes	insects	none	96.6	0.113	87.7-121
<i>Chondestes grammacus</i>	Lark sparrow	Passeriformes	insects, seeds	none	29	0.0669	24.7-33.3
<i>Chordeiles acutipennis</i>	Lesser nighthawk	Caprimulgiformes	insects	none	49.9	0.142	41.0-64.0
<i>Chordeiles minor</i>	Common nighthawk	Caprimulgiformes	insects	none	62	NA	NA
<i>Cistothorus platensis</i>	Sedge wren	Passeriformes	insects	none	9	0.0767	7.2-10.3
<i>Coccyzus americanus</i>	Yellow-billed cuckoo	Cuculiformes	insects	none	64	0.142	50.0-84.6
<i>Colaptes auratus</i>	Northern flicker	Piciformes	insects	fruit	129.5	0.0471	92.2-167
<i>Colinus virginianus</i>	Northern bobwhite	Galliformes	seeds	green plant matter, fruit, insects	176	NA	NA
<i>Contopus virens</i>	Eastern wood-pewee	Passeriformes	insects	none	14.1	0.0645	10.4-18.2
<i>Corvus brachyrhynchos</i>	American crow	Passeriformes	seeds	insects, carrion, fruit, nuts, eggs	448	NA	NA
<i>Cyanocitta cristata</i>	Blue jay	Passeriformes	nuts, seeds	fruit, insects, eggs	86.8	0.0931	64.1-109
<i>Dendroica magnolia</i>	Yellow-rumped (magnolia) warbler	Passeriformes	insects	none	8.7	0.0532	6.6-12.9
<i>Dendroica palmarum</i>	Western palm warbler	Passeriformes	insects	fruit	10.3	0.0456	7.0-12.9
<i>Dendroica petechia</i>	Yellow warbler	Passeriformes	insects	fruit	9.5	0.0667	7.4-16.0
<i>Dryocopus pileatus</i>	Pileated woodpecker	Piciformes	insects	fruit	287	NA	250-309
<i>Dumetella carolinensis</i>	Gray catbird	Passeriformes	fruit	insects	36.9	0.0846	26.6-56.5
<i>Empidonax trailii</i>	Willow flycatcher	Passeriformes	insects	fruit	13.4	0.106	11.3-16.4
<i>Eremophila alpestris</i>	Horned lark	Passeriformes	seeds	insects	31.4	NA	NA
<i>Euphagus cyanocephalus</i>	Brewer's blackbird	Passeriformes	insects, seeds	fruit	62.7	0.066	50.6-73.0
<i>Gallinula chloropus</i>	Common moorhen	Gruiformes	plant matter	aquatic invertebrates	334	0.0737	NA
<i>Geothlypis trichas</i>	Common yellowthroat	Passeriformes	insects	seeds	10.1	0.0714	7.6-15.5

Species (scientific name)	Species (common name)	Order	Predominant diet*	Additional diet items*	Mean body weight (g)**	CV of BW**	BW range (g)**
<i>Guiraca caerulea</i>	Blue grosbeak	Passeriformes	insects	seeds	28.4	0.0485	26.1-31.4
<i>Himantopus mexicanus</i>	Black-necked stilt	Charadriiformes	aquatic invertebrates	fish, reptiles and amphibians	166	NA	NA
<i>Hirundo rustica</i>	Barn swallow	Passeriformes	insects	none	18.6	0.0801	13.4-23.4
<i>Hylocichla mustelina</i>	Wood thrush	Passeriformes	insects	fruit, worms	47.4	0.0880	39.2-57.7
<i>Icteria virens</i>	Yellow-breasted chat	Passeriformes	insects	fruit	25.3	0.0587	20.2-33.8
<i>Icterus galbula</i>	Northern oriole	Passeriformes	insects	fruit, nectar	33.7	0.0673	29-38
<i>Icterus spurius</i>	Orchard oriole	Passeriformes	insects	fruit	19.6	0.0903	16.0-25.1
<i>Junco hyemalis</i>	Dark-eyed junco	Passeriformes	seeds	insects	19.8	0.0585	14.3-26.7
<i>Lanius ludovicianus</i>	Loggerhead shrike	Passeriformes	insects, small mammals, birds	none	47.4	0.0683	40.5-54.1
<i>Limnodromus scolopaceus</i>	Long-billed Dowitcher	Charadriiformes	aquatic invertebrates	seeds	105	NA	90-119
<i>Melanerpes carolinus</i>	Red-bellied woodpecker	Piciformes	nuts, fruit	insects	61.7	0.0872	NA
<i>Melanerpes erythrocephalus</i>	Red-headed woodpecker	Piciformes	nuts, seeds	insects, fruit	71.6	0.106	56.1-90.5
<i>Melospiza melodia</i>	Song sparrow	Passeriformes	seeds	insects	20.8	0.0654	11.9-29.8
<i>Mimus polyglottos</i>	Northern mockingbird	Passeriformes	insects, fruit	none	48.5	NA	36.2-55.7
<i>Molothrus ater</i>	Brown-headed cowbird	Passeriformes	seeds	insects	43.9	0.0429	30.5-58.0
<i>Myiarchus cinerascens</i>	Ash-throated flycatcher	Passeriformes	insects	fruit	27.2	NA	24.0-31.0
<i>Myiarchus crinitus</i>	Great-crested flycatcher	Passeriformes	insects	fruit	33.5	0.0899	27.2-39.6
<i>Passer domesticus</i>	House sparrow	Passeriformes	seeds	insects	27.7	0.0686	20.0-34.5
<i>Passer montanus</i>	Eurasian tree sparrow	Passeriformes	seeds, insects	none	22	0.0532	NA
<i>Passerculus sandwichensis</i>	Savannah sparrow	Passeriformes	seeds	insects	21.9	0.0913	22.2-30.2
<i>Passerina ciris</i>	Painted bunting	Passeriformes	seeds	insects	15.55	NA	12.9-19.0

Species (scientific name)	Species (common name)	Order	Predominant diet*	Additional diet items*	Mean body weight (g)**	CV of BW**	BW range (g)**
<i>Passerina cyanea</i>	Indigo bunting	Passeriformes	insects	seeds, fruit	14.5	0.0966	11.2-21.4
<i>Perdix perdix</i>	Gray partridge	Galliformes	seeds	insects	379	NA	up to 454
<i>Petrochelidon pyrrhonota</i>	Cliff swallow	Passeriformes	insects	none	21.6	0.0944	17.5-26.7
<i>Pheucticus ludovicianus</i>	Rose-breasted grosbeak	Passeriformes	insects	fruit, seeds, flowers	45.6	0.00877	35.4-65.0
<i>Picoides pubescens</i>	Downy woodpecker	Piciformes	insects	fruit, seeds	27	0.00704	20.7-32.2
<i>Pipilo aberti</i>	Abert's towhee	Passeriformes	seeds	insects	46.0	0.0673	39.5-54.1
<i>Pipilo erythrophthalmus</i>	Rufous-sided towhee	Passeriformes	nuts, seeds, fruit	insects	40.5	0.045	32.1-52.3
<i>Pipilo fuscus</i>	Brown towhee	Passeriformes	seeds	fruit, insects	52.9	NA	46.3-61.2
<i>Piranga olivacea</i>	Scarlet tanager	Passeriformes	insects	fruit	28.6	0.00769	17.5-35.2
<i>Plegadis chihi</i>	White-faced ibis	Ciconiiformes	aquatic invertebrates	none	622	0.0837	433-807
<i>Poecile atricapillus</i>	Black-capped chickadee	Passeriformes	insects	seeds, fruit	10.8	0.128	8.2-13.6
<i>Poecile carolinensis</i>	Carolina chickadee	Passeriformes	insects	seeds, fruit	10.2	0.0644	NA
<i>Polioptila caerulea</i>	Blue-gray gnatcatcher	Passeriformes	insects	none	6.0	0.0217	4.8-8.9
<i>Poocetes gramineus</i>	Vesper sparrow	Passeriformes	insects, seeds	none	25.7	NA	NA
<i>Progne subis</i>	Purple martin	Passeriformes	insects	none	49.4	0.0302	NA
<i>Psaltriparus minimus</i>	Bushtit	Passeriformes	insects	plants	5.3	0.0849	4.5-6.0
<i>Quiscalus major</i>	Boat-tailed Grackle	Passeriformes	insects, plant matter	aquatic invertebrates, reptiles, amphibians	167	NA	102-253
<i>Quiscalus mexicanus</i>	Great-tailed Grackle	Passeriformes	plant matter, insects, reptiles, amphibians, aquatic invertebrates	eggs	149	0.113	96-234
<i>Quiscalus quiscula</i>	Common grackle	Passeriformes	seeds	insects, fruit, worms, seeds, reptiles, amphibians, eggs	113.5	NA	NA
<i>Riparia riparia</i>	Bank swallow	Passeriformes	insects	none	14.6	NA	12.0-18.6
<i>Sayornis phoebe</i>	Eastern phoebe	Passeriformes	insects	fruit	19.8	0.377	11.4-24.4
<i>Seiurus aurocapillus</i>	Ovenbird	Passeriformes	insects	plant matter	19.4	0.0629	14.0-28.8
<i>Sialia sialis</i>	Eastern bluebird	Passeriformes	insects	fruit	31.6	0.0291	NA

Species (scientific name)	Species (common name)	Order	Predominant diet*	Additional diet items*	Mean body weight (g)**	CV of BW**	BW range (g)**
<i>Sitta carolinensis</i>	White-breasted nuthatch	Passeriformes	insects	nuts, seeds	21.1	0.113	18.5-26.7
<i>Spiza americana</i>	Dickcissel	Passeriformes	insects	seeds	27	NA	NA
<i>Spizella passerina</i>	Chipping sparrow	Passeriformes	seeds	insects	NA	NA	NA
<i>Spizella pusilla</i>	Field sparrow	Passeriformes	seeds	insects	12.5	0.118	10.2-16.5
<i>Stelgidopteryx serripennis</i>	Northern rough-winged swallow	Passeriformes	insects	none	15.9	0.0365	10.3-18.3
<i>Sturnella magna</i>	Eastern meadowlark	Passeriformes	insects	seeds	89	0.11	NA
<i>Sturnella neglecta</i>	Western meadowlark	Passeriformes	insects	seeds	97.7	NA	NA
<i>Sturnus vulgaris</i>	European starling	Passeriformes	insects	fruit	82.3	NA	NA
<i>Tachycineta bicolor</i>	Tree swallow	Passeriformes	insects	fruit	20.1	0.0786	15.6-25.4
<i>Tachycineta thalassina</i>	Violet-green swallow	Passeriformes	insects	none	14.15	NA	12.5-16.3
<i>Thryothorus ludovicianus</i>	Carolina wren	Passeriformes	insects	seeds, fruit	21	0.0548	NA
<i>Toxostoma rufum</i>	Brown thrasher	Passeriformes	fruit	insects, seeds, reptiles, amphibians	68.8	0.043	57.6-89.0
<i>Troglodytes aedon</i>	House wren	Passeriformes	insects	none	10.7	0.0636	8.9-14.2
<i>Turdus migratorius</i>	American robin	Passeriformes	fruit	insects, worms	77.3	0.00466	63.5-103
<i>Tyrannus forficatus</i>	Scissor-tailed flycatcher	Passeriformes	insects	none	43.2	0.104	36.3-56.3
<i>Tyrannus tyrannus</i>	Eastern kingbird	Passeriformes	insects	fruit	39.5	0.0468	35.8-40.8
<i>Tyrannus verticalis</i>	Western kingbird	Passeriformes	insects	fruit	39.6	0.0694	34.9-44.1
<i>Vermivora peregrina</i>	Tennessee warbler	Passeriformes	insects	nectar, fruit	10	0.0266	7.3-18.4
<i>Vireo griseus</i>	White-eyed vireo	Passeriformes	insects	fruit	11.4	NA	10.0-14.3
<i>Vireo olivaceus</i>	Red-eyed vireo	Passeriformes	insects	fruit	17.3	0.0654	12.0-25.1
<i>Xanthocephalus xanthocephalus</i>	Yellow-headed blackbird	Passeriformes	seeds	insects	64.5	0.0811	42.4-85.5
<i>Zenaida asiatica</i>	White-winged dove	Columbiformes	seeds	none	153	0.0863	125-187
<i>Zenaida macroura</i>	Mourning dove	Columbiformes	seeds	none	119	0.015	NA
<i>Zonotrichia leucophrys</i>	White-crowned sparrow	Passeriformes	seeds	insects	28.12	0.0614	21.0-38.5

Species (scientific name)	Species (common name)	Order	Predominant diet*	Additional diet items*	Mean body weight (g)**	CV of BW**	BW range (g)**
<i>Zonotrichia querula</i>	Harris' sparrow	Passeriformes	seeds	insects	36.3	NA	31.4-41.7

\*From: Gough et al. (1998). \*\*From Dunning (1984). + Based on other pipit species (*Anthus rubescens* and *A. spragueii*). N/A = not available; standard deviation and range data were not provided for all species

### D.3.2. Diets

The feeding preferences of the 117 commonly observed species were characterized using the diet information provided by Gough *et al.* (1998) (**Table D27**). This source distinguishes dietary items into those that are almost exclusive (predominant) and those that are consumed in lesser quantities. Of the commonly observed species in the avian census studies described above, the majority have diets that are predominantly insects and/or seeds. Several species predominantly consume fruit, nuts, plant matter, small animals (mammals, birds, amphibians and reptiles), aquatic invertebrates and nectar (**Table D28**). Many of the commonly observed species have diets that are predominantly composed of one food item (*e.g.*, insects). Several species have diets that are predominantly composed of multiple food items.

**Table D28. Number of Commonly Observed Species with Food Items Representing Predominant Diet**

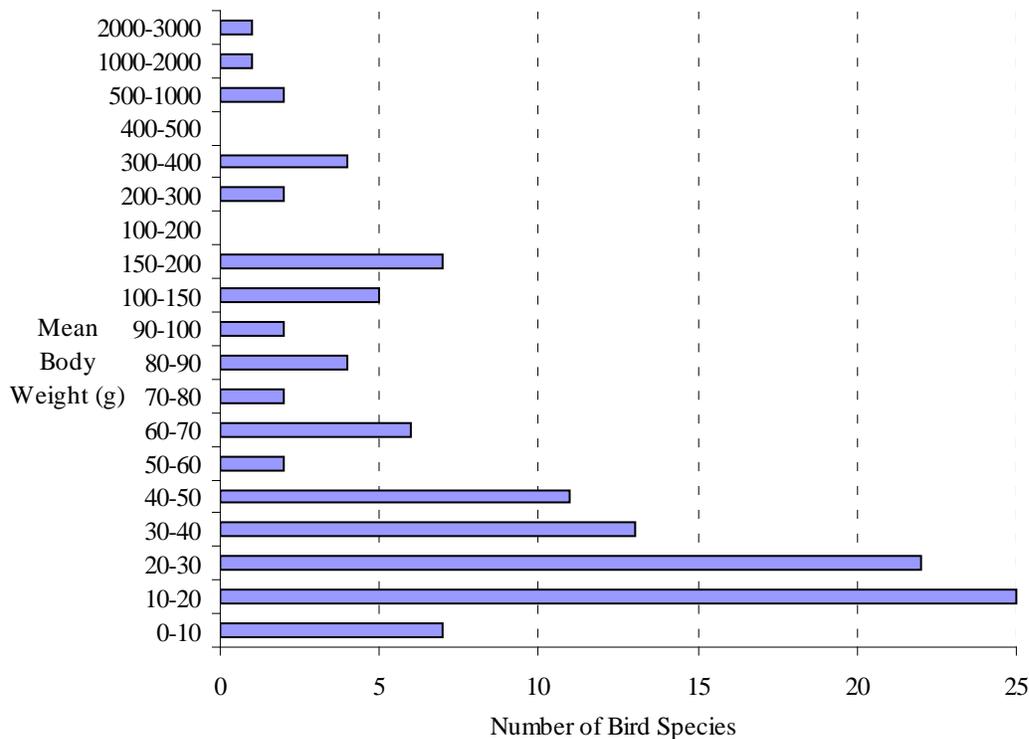
Food item	# species
insects	71
seeds	42
fruit	9
plant matter (green)	6
nuts	5
aquatic invertebrates	5
small animals	3
nectar	1

When given the opportunity, many species will consume additional food items that are outside of the predominant diet (**Table D27**). These additional food items include insects, seeds, fruit, nuts, plant matter, small animals, eggs, worms, aquatic invertebrates, nectar and carrion.

### D.3.3. Body Weights

Body weights of the commonly observed avian species were defined using Dunning (1984), which summarizes studies reporting species specific BWs for 686 species of North American birds. In cases where multiple mean BWs were available for one species, the mean of the means was calculated. This calculation also applies to CV values. It should be noted that body weights from Dunning (1984) are based on adult birds, including both male and female.

For all of the common species, mean BWs range 3.2-2943 g, with a mean of 103 g. **Figure D1** portrays the number of bird species with mean body weights within set ranges. As indicated by this figure, the majority of species (N = 78; 67%) have mean body weights <50 g. When the mean body weights are distributed, the 80<sup>th</sup> percentile is 97 g, suggesting that the majority of the birds commonly found on agricultural fields and their adjacent habitats would be represented by the 20 g and 100 g (mean) BWs of the generic species used in TIM (**Table D29**).



**Figure D1. Number of Commonly Observed Species by Mean Body Weight. Note that the y-axis scale is not uniform (varies from 10 g to 1000 g intervals).**

**Table D29. Summary Statistics for Mean Body Weights of Common Species.**

Statistic	Value (g)
Minimum	3.2
Maximum	2943
Mean	93
25 <sup>th</sup> percentile	20
Median	33
75 <sup>th</sup> percentile	73
80 <sup>th</sup> percentile	97
90 <sup>th</sup> percentile	175

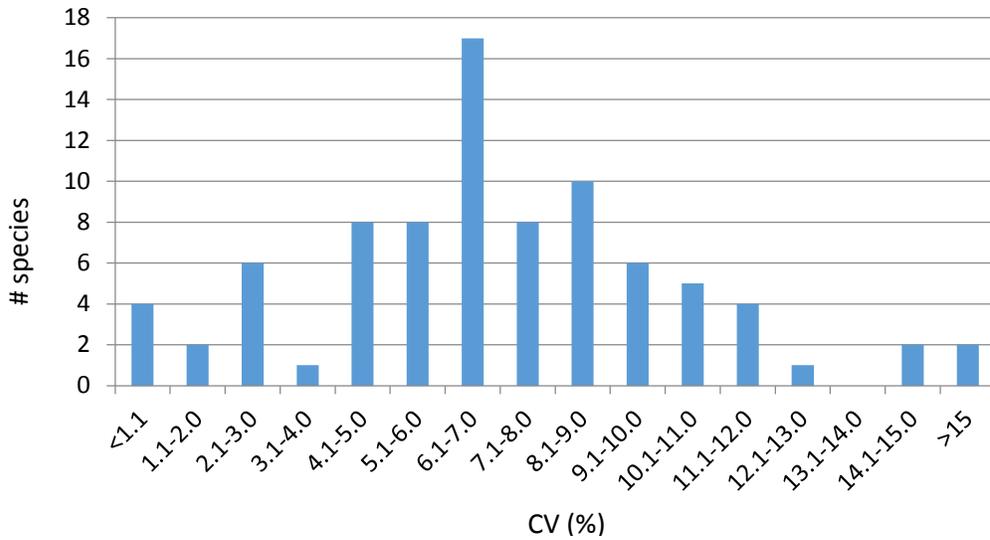
For the common species with CVs, values range 0.5-37.7%, with a mean of 7.3% (N = 84; **Table D30**). The CVs appear to follow a normal distribution (**Figure D2**) and are independent of the mean values for the same species (**Figure D3**). The mean CV (7.3%) value is used to determine standard deviations for the generic species in TIM.

On average, the minimum and maximum body weights for a species are 78% and 131% of the mean, respectively. These values are only 2-3x the CV (7.3%) and will result in truncated lognormal distributions for the generic species. The 90<sup>th</sup> percentiles of the minimum and maximum values are 66% and 152% relative to the mean body weights. These 90<sup>th</sup> percentile values are 5-7x the CV, which will allow for the body weight distributions of the generic species to be more

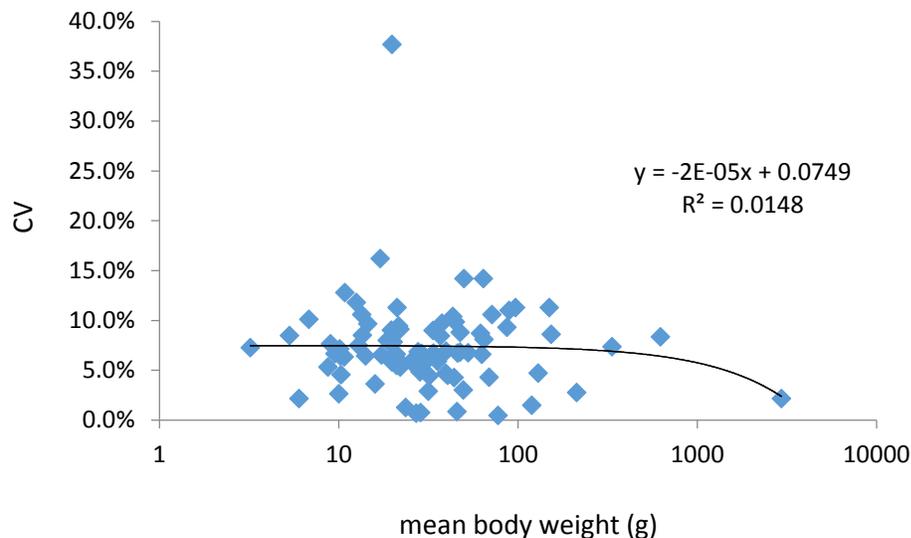
complete. Therefore, the 90<sup>th</sup> percentile percentages are used to determine the minimum and maximum values of the beta distributions for the generic species used in TIM.

**Table D30. Summary Statistics for CVs of Body Weights of Common Species.**

Statistic	Value (%)
Minimum	0.5
Maximum	37.7
Mean	7.3
25 <sup>th</sup> percentile	5.2
Median	6.8
75 <sup>th</sup> percentile	9.0
80 <sup>th</sup> percentile	9.5
90 <sup>th</sup> percentile	11.2



**Figure D2. Number of Commonly Observed Species According to Body Weight CV.**



**Figure D3. Mean Body Weight vs. CV for Species Commonly Observed in Avian Census Studies.**

#### **D.3.4. Frequency on Field**

In TIM, avian species are distinguished as field and edge residents. These classifications impact the FOF values used to represent the species time on the treated field. In order to derive FOF values for the generic species in TIM, it is necessary to define the residency of the commonly observed species. Residency is based on the nesting behavior of a species.

For agricultural fields, species that build their nests on the ground in grassland areas are defined as field residents. In this case, it is assumed that the birds will spend their nights in the field and will forage on and off the treated field. Species are considered edge residents if their nests are established outside of agricultural fields. This includes species that nest on the ground in successional scrub habitats, near water, or in woodlands as well as species that nest in the mid-story (shrubs) or in the canopy (trees). The nest locations and resulting agricultural field residency definitions of the commonly observed avian species are provided in **Table D31**. Of the 112 species, 14 are considered field residents and 98 are edge residents.

For orchards and vineyards, field residents are those that build their nests on the ground in grasslands and woodlands as well as those that build their nests in the mid-story and canopy. Edge residents are those that build their nests on the ground (or low to the ground) in successional scrub habitat and near (or in) wetlands or water. The nest locations and resulting orchard and vineyard residency definitions of the commonly observed avian species in the orchard (apples and citrus) and vineyard (grape) studies are provided in **Table D31**. Of the 26 species that were observed in orchard and vineyard studies, 17 are considered field residents and 9 are edge residents.

**Table D31. Nest Location, Residency Definition and FOF Range of Commonly Observed Species.**

Species (scientific name)	Species (common name)	Nest location (habitat)	Residency (ag. field)	Residency (orchard)	Range of FOF (%)	Crops where species was observed
<i>Agelaius phoeniceus</i>	Red-winged blackbird	ground-low (shrubland)	edge	edge	1-89	alfalfa, cabbage, citrus, corn, cotton, grapes, potatoes, soybeans
<i>Aimophila cassinii</i>	Cassin's sparrow	ground-low (grassland)	field	NA	7	cotton
<i>Ammodramus savannarum</i>	Grasshopper sparrow	ground-low (grassland)	field	NA	15-56	alfalfa, corn
<i>Amphispiza bilineata</i>	Black-throated sparrow	ground-low (successional scrub)	edge	NA	37	cotton
<i>Anas discors</i>	Blue-winged Teal	ground-low (wetland, open water)	edge	NA	65	corn
<i>Anthus spinoletta</i>	Water pipit	ground-low (grassland)	field	NA	45-97	alfalfa
<i>Aphelocoma coerulescens</i>	Scrub jay	ground-low (successional scrub)	NA	edge	55	citrus
<i>Archilochus colubris</i>	Ruby-throated hummingbird	mid-story, canopy	edge	NA	34-58	cotton
<i>Auriparus flaviceps</i>	Verdin	ground-low (successional scrub)	edge	NA	57	cotton
<i>Baeolophus bicolor</i>	Tufted titmouse	mid-story, canopy	edge	NA	0-4	corn, cotton, potatoes
<i>Bombycilla cedrorum</i>	Cedar waxwing	mid-story, canopy	edge	field	0-80	apples, cabbage, corn
<i>Branta canadensis</i>	Canada goose	ground-low (near water)	edge	NA	100	corn
<i>Bubulcus ibis</i>	Cattle Egret	mid-story, canopy	edge	NA	100	corn
<i>Buteo jamaicensis</i>	Red-tailed hawk	mid-story, canopy	edge	NA	0	alfalfa
<i>Butorides striatus</i>	Green-backed heron	mid-story, canopy	edge	NA	0	corn
<i>Calamospiza melanocorys</i>	Lark bunting	ground-low (successional scrub)	edge	NA	7	corn
<i>Calidris minutilla</i>	Least Sandpiper	ground-low (near water)	edge	NA	1	corn
<i>Callipepla californica</i>	California quail	ground-low (successional scrub)	NA	edge	34	citrus
<i>Callipepla gambelii</i>	Gambel's quail	ground-low (successional scrub)	edge	NA	27-31	cotton
<i>Callipepla squamata</i>	Scaled quail	ground-low (successional scrub)	edge	NA	0	cotton
<i>Campylorhynchus brunneicapillus</i>	Cactus wren	ground-low (successional scrub)	edge	NA	0	cotton
<i>Cardinalis cardinalis</i>	Northern cardinal	ground-low (successional scrub)	edge	NA	1-68	alfalfa, corn, cotton, potatoes, soybeans
<i>Cardinalis sinuatus</i>	Pyrrhuloxia	ground-low (successional scrub)	edge	NA	0	cotton
<i>Carduelis tristis</i>	American goldfinch	mid-story, canopy	edge	field	2-84	apples, cabbage, corn, grapes, potatoes
<i>Carpodacus mexicanus</i>	House finch	mid-story, canopy	edge	field	2-32	citrus, cotton
<i>Catharus ustulatus</i>	Swainson's thrush	ground-low (woodland)	edge	NA	20	corn

Species (scientific name)	Species (common name)	Nest location (habitat)	Residency (ag. field)	Residency (orchard)	Range of FOF (%)	Crops where species was observed
<i>Chaetura pelagica</i>	Chimney swift	mid-story, canopy	edge	NA	70-98	corn, cotton, potatoes
<i>Charadrius vociferus</i>	Killdeer	ground	field	field	65-100	alfalfa, cabbage, corn, grapes, soybeans
<i>Chondestes grammacus</i>	Lark sparrow	ground-low (successional scrub)	edge	NA	33-79	corn, cotton
<i>Chordeiles acutipennis</i>	Lesser nighthawk	ground-low (successional scrub)	edge	NA	63	cotton
<i>Chordeiles minor</i>	Common nighthawk	ground	field	NA	98	corn
<i>Cistothorus platensis</i>	Sedge wren	ground-low (grassland)	field	NA	0	corn
<i>Coccyzus americanus</i>	Yellow-billed cuckoo	ground-low (woodland)	edge	NA	0-6	cotton
<i>Colaptes auratus</i>	Northern flicker	mid-story, canopy	edge	NA	0-29	cabbage, corn, potatoes
<i>Colinus virginianus</i>	Northern bobwhite	ground-low (successional scrub)	edge	NA	1-53	alfalfa, corn, cotton, potatoes
<i>Contopus virens</i>	Eastern wood-pewee	mid-story, canopy	edge	NA	0-3	cabbage, corn, potatoes
<i>Corvus brachyrhynchos</i>	American crow	mid-story, canopy	edge	field	3-74	Apples, cabbage, corn, potatoes, soybeans
<i>Cyanocitta cristata</i>	Blue jay	mid-story, canopy	edge	field	1-67	alfalfa, apples, cabbage, corn, cotton, potatoes
<i>Dendroica magnolia</i>	Yellow-rumped (magnolia) warbler	mid-story, canopy	edge	NA	9	corn
<i>Dendroica palmarum</i>	Western palm warbler	ground-low (successional scrub)	edge	NA	16	corn
<i>Dendroica petechia</i>	Yellow warbler	mid-story, canopy	edge	NA	0-29	corn, potatoes
<i>Dryocopus pileatus</i>	Pileated woodpecker	mid-story, canopy	edge	NA	0	corn
<i>Dumetella carolinensis</i>	Gray catbird	ground-low (successional scrub)	edge	NA	0-28	cabbage, corn, potatoes
<i>Empidonax trailii</i>	Willow flycatcher	ground-low (successional scrub)	edge	NA	0	corn
<i>Eremophila alpestris</i>	Horned lark	ground-low (grassland)	field	NA	36-88	corn, cotton, soybeans
<i>Euphagus cyanocephalus</i>	Brewer's blackbird	mid-story, canopy	edge	field	0-40	citrus, corn
<i>Gallinula chloropus</i>	Common moorhen	ground-low (near water)	edge	NA	0	cotton
<i>Geothlypis trichas</i>	Common yellowthroat	ground-low (successional scrub)	edge	NA	0-46	cabbage, corn, cotton, potatoes
<i>Guiraca caerulea</i>	Blue grosbeak	ground-low (successional scrub)	edge	NA	29	cotton
<i>Himantopus mexicanus</i>	Black-necked stilt	ground-low (wetland, open water)	edge	NA	33	corn
<i>Hirundo rustica</i>	Barn swallow	mid-story, canopy	edge	field	1-99	alfalfa, apples, cabbage, corn, cotton, potatoes, soybeans
<i>Hylocichla mustelina</i>	Wood thrush	mid-story, canopy	edge	NA	1	potatoes

Species (scientific name)	Species (common name)	Nest location (habitat)	Residency (ag. field)	Residency (orchard)	Range of FOF (%)	Crops where species was observed
<i>Icteria virens</i>	Yellow-breasted chat	ground-low (successional scrub)	edge	NA	0-2	corn, cotton
<i>Icterus galbula</i>	Northern oriole	mid-story, canopy	edge	NA	1-68	corn, cotton
<i>Icterus spurius</i>	Orchard oriole	mid-story, canopy	edge	NA	0-18	corn
<i>Junco hyemalis</i>	Dark-eyed junco	ground-low (woodland)	edge	NA	11	alfalfa
<i>Lanius ludovicianus</i>	Loggerhead shrike	mid-story, canopy	edge	NA	17	cotton
<i>Limnodromus scolopaceus</i>	Long-billed Dowitcher	ground-low (grassland)	field	NA	10	corn
<i>Melanerpes carolinus</i>	Red-bellied woodpecker	mid-story, canopy	edge	NA	0-18	corn, cotton, potatoes
<i>Melanerpes erythrocephalus</i>	Red-headed woodpecker	mid-story, canopy	edge	NA	8-50	corn
<i>Melospiza melodia</i>	Song sparrow	ground-low (successional scrub)	edge	edge	5-100	apples, cabbage, corn, grapes, potatoes, soybeans
<i>Mimus polyglottos</i>	Northern mockingbird	ground-low (urban)	edge	edge	4-35	citrus, cotton, potatoes
<i>Molothrus ater</i>	Brown-headed cowbird	mid-story, canopy (other birds' nests)	edge	field	3-100	alfalfa, apples, cabbage, citrus, corn, cotton, potatoes
<i>Myiarchus cinerascens</i>	Ash-throated flycatcher	ground-low (successional scrub)	NA	edge	23	citrus
<i>Myiarchus crinitus</i>	Great-crested flycatcher	mid-story, canopy	edge	NA	0-4	cabbage, corn, potatoes
<i>Passer domesticus</i>	House sparrow	mid-story, canopy	edge	NA	13-63	alfalfa, corn, soybeans
<i>Passer montanus</i>	Eurasian tree sparrow	mid-story, canopy	edge	NA	0	corn
<i>Passerculus sandwichensis</i>	Savannah sparrow	ground-low (grassland)	field	field	14-87	alfalfa, apples, cabbage, corn, grapes
<i>Passerina ciris</i>	Painted bunting	ground-low (successional scrub)	edge	NA	28	cotton
<i>Passerina cyanea</i>	Indigo bunting	ground-low (successional scrub)	edge	NA	0-44	cabbage, corn, cotton, potatoes
<i>Perdix perdix</i>	Gray partridge	ground-low (grassland)	field	NA	35	corn
<i>Petrochelidon pyrrhonota</i>	Cliff swallow	mid-story, canopy	edge	NA	53-100	cabbage, corn, cotton
<i>Pheucticus ludovicianus</i>	Rose-breasted grosbeak	mid-story, canopy	edge	NA	0-6	cabbage, corn
<i>Picoides pubescens</i>	Downy woodpecker	mid-story, canopy	edge	NA	0-51	corn, cotton, potatoes
<i>Pipilo aberti</i>	Abert's towhee	ground-low (successional scrub)	edge	NA	39-50	cotton
<i>Pipilo erythrophthalmus</i>	Rufous-sided towhee	ground-low (successional scrub)	edge	NA	1-6	cotton, potatoes
<i>Pipilo fuscus</i>	Brown towhee	ground-low (successional scrub)	NA	edge	49	citrus
<i>Piranga olivacea</i>	Scarlet tanager	mid-story, canopy	edge	NA	0	potatoes
<i>Plegadis chihi</i>	White-faced ibis	ground-low (marsh)	edge	NA	96	corn

Species (scientific name)	Species (common name)	Nest location (habitat)	Residency (ag. field)	Residency (orchard)	Range of FOF (%)	Crops where species was observed
<i>Poecile atricapillus</i>	Black-capped chickadee	mid-story, canopy	edge	NA	0-48	alfalfa, cabbage, corn
<i>Poecile carolinensis</i>	Carolina chickadee	mid-story, canopy	edge	NA	0-8	alfalfa, cotton, potatoes
<i>Poliophtila caerulea</i>	Blue-gray gnatcatcher	mid-story, canopy	edge	NA	1	cotton
<i>Poocetes gramineus</i>	Vesper sparrow	ground-low (grassland)	field	NA	13-50	alfalfa, corn, soybeans
<i>Progne subis</i>	Purple martin	mid-story, canopy	edge	NA	95-100	corn, soybeans
<i>Psaltriparus minimus</i>	Bushtit	mid-story, canopy	NA	field	34	citrus
<i>Quiscalus major</i>	Boat-tailed Grackle	mid-story, canopy	edge	NA	68	corn
<i>Quiscalus mexicanus</i>	Great-tailed Grackle	mid-story, canopy	edge	NA	35	corn
<i>Quiscalus quiscula</i>	Common grackle	mid-story, canopy	edge	NA	2-97	alfalfa, cabbage, corn, cotton, potatoes, soybeans
<i>Riparia riparia</i>	Bank swallow	mid-story, canopy	edge	field	34-99	apples, corn
<i>Sayornis phoebe</i>	Eastern phoebe	mid-story, canopy	edge	NA	0	corn
<i>Seiurus aurocapillus</i>	Ovenbird	ground-low (woodland)	edge	NA	0	potatoes
<i>Sialia sialis</i>	Eastern bluebird	mid-story, canopy	edge	field	76-79	apples, corn
<i>Sitta carolinensis</i>	White-breasted nuthatch	mid-story, canopy	edge	NA	0	cabbage, corn
<i>Spiza americana</i>	Dickcissel	ground-low (grassland)	field	NA	16-100	alfalfa, corn, cotton
<i>Spizella passerina</i>	Chipping sparrow	mid-story, canopy	edge	field	15-88	alfalfa, apples, grapes, corn, soybeans
<i>Spizella pusilla</i>	Field sparrow	ground-low (successional scrub)	edge	NA	3-100	corn
<i>Stelgidopteryx serripennis</i>	Northern rough-winged swallow	mid-story, canopy	edge	NA	74-99	corn, cotton
<i>Sturnella magna</i>	Eastern meadowlark	ground-low (grassland)	field	NA	88-89	alfalfa, corn
<i>Sturnella neglecta</i>	Western meadowlark	ground-low (grassland)	field	NA	0-33	alfalfa, corn
<i>Sturnus vulgaris</i>	European starling	mid-story, canopy	edge	field	0-86	apples, citrus, corn, potatoes, soybeans
<i>Tachycineta bicolor</i>	Tree swallow	mid-story, canopy	edge	NA	0-69	cabbage, cotton
<i>Tachycineta thalassina</i>	Violet-green swallow	mid-story, canopy	edge	NA	56	cotton
<i>Thryothorus ludovicianus</i>	Carolina wren	ground-low (successional scrub)	edge	NA	0-1	cotton, potatoes
<i>Toxostoma rufum</i>	Brown thrasher	ground-low (successional scrub)	edge	NA	1-53	corn, potatoes
<i>Troglodytes aedon</i>	House wren	mid-story, canopy	edge	NA	0-24	alfalfa, corn, potatoes

Species (scientific name)	Species (common name)	Nest location (habitat)	Residency (ag. field)	Residency (orchard)	Range of FOF (%)	Crops where species was observed
<i>Turdus migratorius</i>	American robin	mid-story, canopy	edge	field	2-87	alfalfa, apples, cabbage, citrus, corn, grapes, potatoes, soybeans
<i>Tyrannus forficatus</i>	Scissor-tailed flycatcher	mid-story, canopy	edge	NA	19	cotton
<i>Tyrannus tyrannus</i>	Eastern kingbird	mid-story, canopy	edge	field	6-45	alfalfa, corn, grapes
<i>Tyrannus verticalis</i>	Western kingbird	mid-story, canopy	edge	field	13-92	citrus, corn, cotton
<i>Vermivora peregrina</i>	Tennessee warbler	ground-low (woodland)	edge	NA	0	corn
<i>Vireo griseus</i>	White-eyed vireo	ground-low (successional scrub)	edge	NA	0-2	cotton, potatoes
<i>Vireo olivaceus</i>	Red-eyed vireo	mid-story, canopy	edge	NA	0-1	corn, potatoes
<i>Xanthocephalus xanthocephalus</i>	Yellow-headed blackbird	ground-low (wetland, open water)	edge	NA	4-100	corn, cotton
<i>Zenaida asiatica</i>	White-winged dove	mid-story, canopy	edge	NA	6	cotton
<i>Zenaida macroura</i>	Mourning dove	mid-story, canopy	edge	field	0-73	alfalfa, apples, citrus, corn, cotton, potatoes, soybeans
<i>Zonotrichia leucophrys</i>	White-crowned sparrow	ground-low (successional scrub)	edge	NA	48	corn
<i>Zonotrichia querula</i>	Harris' sparrow	ground-low (successional scrub)	edge	NA	6-12	alfalfa

NA = not applicable

To determine the default mean FOF values for the generic field and edge resident species using agricultural fields, FOF values for all commonly observed species from the alfalfa, cabbage, corn, cotton, potatoes and soybeans avian census studies were compiled. For the field residents, FOF values ranged from 0 to 100%, with a mean and median of 53%. The 90<sup>th</sup> percentile for the field residents was 97%. For the edge residents, FOF values ranged from 0 to 100%, with a mean and median of 25% and 16%, respectively. The 90<sup>th</sup> percentile for the edge residents was 69% (**Table D32**). The 90<sup>th</sup> percentile values are used as the default mean FOF values for the generic species in TIM.

To determine the default mean FOF values for the generic field and edge resident species using orchards and vineyards, FOF values for all commonly observed species from the apple, citrus and grape avian census studies were compiled. For the field residents, FOF values ranged from 13 to 98%, with a mean and median of 64 and 74%, respectively. The 90<sup>th</sup> percentile for the field residents was 87%. For the edge residents, FOF values ranged from 3 to 99%, with a mean and median of 57%. The 90<sup>th</sup> percentile for the edge residents was 85% (**Table D32**). The 90<sup>th</sup> percentile values are used as the default mean FOF values for the generic species in TIM. When considering all FOF values from vineyard and orchard studies, the 90<sup>th</sup> percentile FOF is 87%. Given that the FOF values for edge and field residents are so similar and that these values are based on a limited number of species and observations, only one FOF value (*i.e.*, 87%) will be used to represent all species visiting vineyards and orchards.

**Table D32. Summary Statistics for FOF (%) of Common Species.**

Statistic	All values	Agricultural Field		Vineyard/Orchard	
		Field resident	Edge resident	Field resident	Edge resident
N (# FOF values)	446	44	361	29	14
# species	117	14	98	17	9
Minimum	0	0	0	13	3
Maximum	100	100	100	98	99
Mean	31	53	25	64	57
25 <sup>th</sup> percentile	3	27	2	41	38
Median	22	53	16	74	57
75 <sup>th</sup> percentile	51	84	37	80	78
<b>90<sup>th</sup> percentile</b>	<b>84</b>	<b>97*</b>	<b>69*</b>	<b>87*</b>	<b>85*</b>

\*Default values for generic species.

#### D.4. Uncertainties

The purpose of this review was to identify avian species that are representative of those that commonly visit agricultural fields. This review was not intended to be inclusive of every relevant species of birds visiting agricultural fields in North America. In addition, this review does not include species from Alaska, Hawaii and the US territories.

In general, the body weight distributions were derived using available body weight data for adult birds. The representativeness of these body weights on juvenile birds is unknown.

One notable uncertainty associated with the empirical FOF data used to derive the default mean FOF values for the generic species is that the majority of the census studies were conducted during the spring and summer months. Therefore, FOF values representative of fall and winter months are unknown.

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