

Golden-winged Warbler (*Vermivora chrysoptera*) Habitat Preference in Michigan's Northern Lower Peninsula

Carrie Coy, Maria La Gattuta, Mark Smith, and Megan Splitt

University of Michigan Biological Station

EEB 330 Biology of Birds

June 16, 2016

Dr. Dave Ewert

Abstract

Populations of birds are often limited by habitat, competition, and lack of food resources. The Golden-winged Warbler population has been steadily declining globally and in the Great Lakes region presumably due to a combination of these factors. In this study, we conducted point counts at 10 upland and 10 lowland randomly selected sites in Emmet and Cheboygan counties and recorded all birds and estimated plant coverage. Based on research of Golden-winged Warbler habitat, we predicted Golden-winged Warblers (*Vermivora chrysoptera*) to be more abundant in lowland areas as opposed to upland areas with comparable early succession. However, we did not find a significant difference between Golden-winged Warbler's habitat preference between upland and lowland sites. However, the results must be cautiously interpreted given the methodological limitations of our study.

I grant the Regents of the University of Michigan the non-exclusive right to retain, reproduce, and distribute my paper, titled in electronic formats and at no cost throughout the world.

The University of Michigan may make and keep more than one copy of the Paper for purposes of security, backup, preservation and access, and may migrate the Paper to any medium or format for the purpose of preservation and access in the future.

Signed,

Megan Splitt

Mark Smith

Carrie O. Coy

Maria La Gattuta

Introduction

The Golden-winged Warbler (*Vermivora chrysoptera*) has recently suffered a sharp decline: one of the most drastic of any North American songbirds (Cornell Lab of Ornithology, All About Birds). In the last few decades their populations have declined 2.4% annually survey-wide and 9.0% in the Fish and Wildlife Service Region 3 which includes the Great Lakes Region (Golden-winged Warbler Working Group: Executive Summary). They are now restricted to two disjunct breeding areas: the Great Lakes region and higher elevations in the Appalachians. This decline is attributed to competition with the Blue-winged Warbler (*Vermivora cyanoptera*) throughout much of its breeding range, and loss of its preferred early-to-mid successional habitat. Therefore, if the preferred habitat of the Golden-winged Warbler in the Great Lakes region is known, which is thought to support a relatively high proportion of the total population, it could provide information to guide future conservation efforts for the Golden-winged Warblers, such as habitat preservation, management, or creation.

The purpose of this survey was to determine the relative abundance of Golden-winged Warblers in upland habitat versus lowland habitat. In order to determine the preferred habitat for the Golden-winged Warblers, we collected data in each type of habitat in the Golden-winged Warbler Working Group's conservation area of concern on the northwestern side of Michigan's lower peninsula. The Golden-winged Warbler Working Group hints in the Best Management Practice guides that Golden-winged Warblers in the Great Lakes region are most common to lowland habitats, whereas in the Appalachian region Golden-winged Warblers may be most frequently found in upland habitats (Golden-winged Warbler Working Group: Executive

Summary). We predicted we would observe a greater number of breeding Golden-winged Warblers in lowland habitats of northern Michigan compared to upland sites.

Materials and Methods

Point counts were conducted by first locating suitable habitats via Google Maps, 2014 images and from the Michigan Department of Natural Resources Mi-HUNT application (see Appendix 1). In an attempt to maximize the number of Golden-winged Warblers found at each point-count site, mostly shrubby early successional-looking habitats, preferred by Golden-winged Warblers, were located and selected because prior research suggested that these would be suitable habitats for Golden-winged Warblers (Golden-winged Warbler Working Group: Golden-winged Warbler Habitats in the Great Lakes Region). When looking at the satellite imagery, we selected sites which appeared to contain patches of early successional shrubs and lowlands with clearings, which were close to rivers, ponds or open water. We also restricted our point counts to morning when Golden-winged Warblers are most detectable. After 11:30 AM, we determined it was too late in the day to collect data because Golden-winged Warblers are usually active early in the morning and at later times are less likely to respond to playback. Once potential sites were selected, twenty sites were randomly selected at which to conduct point counts, 10 each of upland and lowland habitat (see Figure 1 for locations and coordinates of sampled sites).

We conducted twenty 25 m-radius point counts from 28 May through 8 June 2016 in Emmet and Cheboygan counties, Michigan, which was before Golden-winged Warblers fledged and moved to habitats that we did not sample (Cornell Lab of Ornithology: All About Birds). At each habitat, data collection began by walking 50 meters into the habitat to minimize edge

effects, and pausing for two minutes to minimize any disturbance of the birds created by entering the habitat. At this point, the time of day was recorded. In addition, the sky condition, wind, temperature, and coordinates of the site were also noted. For wind condition, 0, 1, 2, 3, 4, 5, and 6 were used to represent calm, light air, light breeze, gentle breeze, moderate breeze, fresh breeze and strong breeze respectively. For sky condition, 0, 1, 2, and 3 were used to symbolize clear or few clouds, partly cloudy, cloudy, and rain, respectively. We conducted our point counts regardless of the weather, although ideally we would have done so on days without rain and strong winds as birds are usually being more active on days without rain. We conducted 13 point counts in ideal weather, making up of 65% of our data. After the two minute pause, the recording of time of day, and other site-specific data, the point counts were initiated. A stopwatch was used to keep time, and the birds identified were recorded in 3-three minute and twenty second intervals. (Making the total time of each point count 10 minutes.) Point counts at each site were followed by another pause of one minute, and then playback of Golden-winged Warbler song and call was used to detect any Golden-winged Warblers not located during point counts. Playback was used for three minutes at each site, and then for two minutes the surrounding area was scanned for any visual or audio sign of Golden-winged Warblers. Playback devices were two Apple iPods, which played Golden-winged Warbler songs and calls from Audubon Bird Guide: North America application (National Audubon Society). We recorded all birds detected by sight, call, or song, including approximate distance from the center of the point count. Also, the sex of the bird and time period it was observed within was recorded, along with the scientific names, species, and percent coverage of the most common plants.

Figure 1. Map of all study sites sampled for Golden-winged Warblers in Emmet and Cheboygan counties, Michigan during May and June 2016.

Upland sites: **A** (45°37'22.8"N, 84°40'40.8"W), **D** (45°34'21.8"N, 84°48'49.0"W), **E** (45°32'44.9"N, 84°47'26.6"W), **F** (45°33'28.8"N, 84°45'25.2"W), **G** (45°34'18.2"N, 84°45'19.7"W), **M** (45°42'14.4"N, 84°46'48.0"W), **P** (45°34'37.2"N, 84°59'24.0"W), **Q** (45°26'34.8"N, 84°56'02.4"W), **T** (45°30'36.0"N, 84°43'33.6"W), **W** (45°37'40.5"N, 84°44'25.1"W).

Lowland sites: **B** (45°36'12.8"N, 84°42'42.9"W), **H** (45°34'23.4"N, 84°44'44.4"W), **I** (45°34'21.6"N, 84°43'44.8"W), **J** (45°33'10.8"N, 84°40'58.8"W), **K** (45°35'42.7"N, 84°45'21.6"W), **L** (45°33'04.8"N, 84°44'58.7"W), **O** (45°26'02.4"N, 84°47'27.6"W), **R** (45°24'54.0"N, 84°44'31.2"W), **S** (45°40'54.9"N, 84°48'24.0"W), **Y** (45°35'25.7"N, 84°42'42.7"W).



Results

We tested the hypothesis that there would be significantly more observations of Golden-winged Warblers in lowland sites than upland sites. Because our data were not normally distributed, we used the nonparametric Rank Sum Test to test our hypothesis (see Table 1 above). All sites were pooled, and then upland sites were separated from lowland sites. The totaled rank sums for upland and lowland sites were 115 and 95, respectively. To reject the null hypothesis, the totaled rank sum must be less than 78 for our sample size ($n_1=10$, $n_2=10$) (Ambrose and Ambrose, 1987). Consequently, we did not reject the null hypothesis that the mean of upland site observations is significantly different than the mean of lowland site observations.

Only two Golden-winged Warblers were encountered, both in lowland sites (H and L and none in upland sites), despite the presence of bird and plant species that are commonly associated with their habitat occurring at many of the sites. We assessed plant community species and composition in both the lowland and upland sites by visually estimating the percent coverage of dominant plants from the center of the point count area. The most common bird species in upland and lowland habitats were recorded (Table 2), and percent coverage of common plant species was estimated in uplands and lowlands (Table 3); see Appendix 1 for data from each sampled point. Both upland and lowland habitats surveyed were similar to descriptions of breeding habitats used by the Golden-winged Warbler Working Group: early successional areas with sparse trees and shrubs, and clearings with forbs and grasses bordering a deciduous forest.

Table 1. Rank Sum Test

Combined	Rank	Upland	Rank	Lowland	Rank
0 (A)	11.5	0 (A)	11.5	0 (B)	11.5
0 (B)	11.5	0 (D)	11.5	0 (I)	11.5
0 (D)	11.5	0 (E)	11.5	0 (J)	11.5
0 (E)	11.5	0 (F)	11.5	0 (K)	11.5
0 (F)	11.5	0 (G)	11.5	0 (O)	11.5
0 (G)	11.5	0 (M)	11.5	0 (R)	11.5
0 (I)	11.5	0 (P)	11.5	0 (S)	11.5
0 (J)	11.5	0 (Q)	11.5	0 (Y)	11.5
0 (K)	11.5	0 (T)	11.5	1 (H) (<25m)	1.5
0 (M)	11.5	0 (W)	11.5	1(L) (>25m)	1.5
0 (O)	11.5				
0 (P)	11.5				
0 (Q)	11.5				
0 (R)	11.5				
0 (S)	11.5				
0 (T)	11.5				
0 (W)	11.5				
0 (Y)	11.5				
1 (H)	1.5				
1 (L)	1.5	Σ upland = 115		Σ lowland = 95	

Based on the “Table of critical values for the Rank Sum Test at the .05 alpha level” from “A Handbook of Biological Investigation Fourth Edition, 1987”, any value less than 78 would show

a significant difference between the number of observations of Golden-winged Warblers at upland and lowland sites. We failed to reject the null hypothesis because 95 is not less than 78.

Table 2. The number of sites we saw the most commonly observed birds in upland (A) and lowland (B) habitats.

(A)

Species	Scientific name	Upland totals
Ovenbird	<i>Seiurus aurocapilla</i>	7
Red-eyed Vireo	<i>Vireo olivaceus</i>	6
American Redstart	<i>Setophaga ruticilla</i>	4
Black-capped Chickadee	<i>Poecile atricapillus</i>	4
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	3
Nashville Warbler	<i>Leiothlypis ruficapilla</i>	3

(B)

Species	Scientific name	Lowland totals
Nashville Warbler	<i>Leiothlypis ruficapilla</i>	6
Black-and-white Warbler	<i>Mniotilta varia</i>	5
White-throated Sparrow	<i>Zonotrichia albicollis</i>	5
Alder Flycatcher	<i>Empidonax alnorum</i>	4
American Redstart	<i>Setophaga ruticilla</i>	3
Ovenbird	<i>Seiurus aurocapilla</i>	3
Red-eyed Vireo	<i>Vireo olivaceus</i>	3

Table 3. The most common observed plants in both upland (A) and lowland (B) habitats.

(A)

Upland Plants		
Species	Scientific name	% coverage
bracken fern	<i>Pteridium aquilinum</i>	19.50%
beech	<i>Fagus grandifolia</i>	10.00%
showy honeysuckle	<i>Lonicera x bella</i>	8.10%
white pine	<i>Pinus strobus</i>	5.50%
sugar maple	<i>Acer saccharum</i>	4.00%
red pine	<i>Pinus resinosa</i>	4.00%

(B)

Lowland plants		
Genus	Scientific name	% coverage
speckled alder	<i>Alnus incana</i>	18.80%
grass	<i>Poaceae spp.</i>	17.50%
leatherleaf	<i>Chamaedaphne calyculata</i>	7.40%
sensitive fern	<i>Onoclea sensibilis</i>	7.00%
eastern white cedar	<i>Thuja occidentalis</i>	6.50%
meadowsweet	<i>Spiraea alba</i>	3.50%
trembling aspen	<i>Populus tremuloides</i>	3.20%
nannyberry	<i>Viburnum lentago</i>	3.00%

Discussion

Although the only two Golden-winged Warblers we found were located in lowland habitats, there was not enough evidence to conclude that Golden-winged Warblers prefer lowland habitats to upland habitats. However, it should be noted that both sites at which Golden-winged Warblers were spotted were lowland site. Furthermore, the Golden-winged Warbler Working Group listed possible Golden-winged Warbler habitats in the Great Lakes Region Best Management Practices as deciduous forests, aspen parkland transition zones, shrub wetlands, and utility rights-of-way, which is consistent with both of our sites where Golden-winged Warblers were observed. A Golden-winged Warbler was heard singing just outside of our 25 meter radius at Site L (a utility rights-of-way) and we heard and saw a Golden-winged Warbler within 25 meters at Site H (a shrubby wetland). These initial results suggest that Golden-winged Warblers may prefer lowland habitats in the area we sampled but require additional studies.

Furthermore, according to the Golden-winged Warbler working group, “analyses of recent population trends suggest a very rapid rate of decline in the northern portion of the range” despite the fact that “the northern range once seemed to provide refuge for Golden-winged Warblers” (Golden-winged Warbler Working Group, Executive Summary). The Michigan Breeding Bird Atlas II also states that between the censuses for Michigan Breeding Bird Atlas I (mid-1980s) and II (mid-2000s) the Golden-winged Warbler population decreased by 34% and supports our hypothesis that Golden-winged Warblers in Michigan may prefer shrub wetlands and early successional habitats (Michigan Breeding Bird Atlas, Appendix 3: Comparison of Township totals from MBBA I to MBBA II). Despite these decreases in regional and state

populations, the population of Golden-winged Warblers in Emmet and Cheboygan counties has remained approximately constant between the 1980s and 2000s (Michigan Breeding Bird Atlas I & II, Golden-winged Warbler). This population was sparse and scattered in these study areas with approximately the same number of atlas blocks supporting Golden-winged Warblers during the two atlases and is consistent with our observations. Similarly, the eBird Range map for Golden-winged Warblers indicates their distribution is scattered across northern Michigan, as we found (eBird, Range Map). eBird's range map of Blue-winged Warblers (*Vermivora cyanoptera*) shows that they remain rare in our area. Since we did not see any Blue-winged Warblers at our study sites, or elsewhere in the region during other field work, we do not attribute Golden-winged Warbler's scarcity in our study area to interactions with Blue-winged Warblers.

It is important to note that we found goldenrods (*Solidago spp.*) in some of the habitats, which is one of the plants in which Golden-winged Warblers like to build nests (Cornell Lab of Ornithology: All About Birds). We also found raspberry plants (*Rubus spp.*), similar to blackberry plants, which is another one of the preferred plants to locate nests. This shows that these habitats may be suitable for Golden-winged Warblers, yet since they are quite scattered in our area, they have found or chosen to live in few of these habitats.

Management

Since Golden-winged Warblers are scarce in our area, presumably due to lack of habitat, creating possible habitats could increase the species' population. One site where a Golden-winged Warbler was found in our point counts was a shrubby lowland area bordering a river. One way to create habitat similar to this is to let natural ecological processes take place

without, or at least with little, human intervention. For example, if a wildfire starts and is not endangering persons, private property, or endangered species, it should be allowed to cover at least a five acre area to create suitable habitat before it is extinguished. Also, beavers should be allowed to create dams and subsequently flood areas to make wetlands.

A more controlled method is to clear strips of trees and brush from a wetland or the area surrounding a wetland. Optimally, about 25% of the wetland would be cut every four to five years, so the entire area is under treatment within 20 years. However, the 25% of the wetland to be mowed or cut should be done in patches of less than five acres. This will create clearings and many uneven-aged clumps of vegetation. Treatment blocks of five or more acres should retain 50% of the shrub and vegetation patchwork. Canopy trees should be thinned to about 10-15 trees per acre (Golden-winged Warbler Working Group: Golden-winged Warbler Habitats in the Great Lakes Region). Of course, either of these methods should not be undertaken if rare plants, birds or other species would be threatened by these acts. These treatment plans will create upland and lowland habitats either by natural or manipulated succession.

Utility rights-of-ways often create optimal habitat for Golden-winged Warblers because power companies must keep these areas free of large trees and brush. Thus, early successional habitats are continuously created in these rights-of-ways. (It is worth noting that one of the two Golden-winged Warblers encountered in our point counts was seen in a utility rights-of-way.) Additional efforts are not needed to keep these habitats early successional, however, there should be an agreement with these power companies to avoid using herbicides and pesticides in those areas suitable for Golden-winged Warblers.

Before starting a treatment plan, invasive species must be identified and, if necessary, removed or treated. Two widespread invasive species which were found in our study sites include showy honeysuckle and spotted knapweed. Showy honeysuckle (*Lonicera x bella*) is an invasive bush honeysuckle that depletes moisture and nutrients in the soil and releases toxins to inhibit nearby plants from growing. This plant should be cut and treated with herbicides to prevent it from converting woodlands into dense invasive shrub thickets, as it will without treatment (Northeastern Area State and Private Forestry: Forest Invasive Plants Resource Center). Spotted knapweed (*Centaurea stoebe*) is a widely distributed herbaceous forb that invades a variety of habitats, spreads rapidly and can survive on very poor nutrient soil. It displaces native vegetation and forage for wildlife (National Park Service, Herbaceous Forbs).

Golden-winged Warblers prefer to nest near plants like blackberries and goldenrods, so in these treatment areas, it may be beneficial to plant some of these species, if they don't already exist. However, caution should be taken to plant native species and monitor their status because some species form dense stands, like Canada goldenrod (*Solidago canadensis*) (United States Department of Agriculture, Plant Guide). As with any study, throughout and after treatment, the treatment area should be monitored for invasives, number of desired species, and habitat success.

Future Work

Future studies could apply our results to find habitats that include the plants present where we found Golden-winged Warblers. Thus, more specific habitats could be targeted for sampling Golden-winged Warblers, thereby increasing the efficiency of finding more Golden-winged Warblers. Other research could include Golden-winged Warbler habitat

preferences in more detail. Some possible habitats include: stagnant waters in lowland habitats that might provide a plentiful food source, post-wildfire upland habitats and/or post-flood lowland habitats which contribute to more and patchier habitats, oak trees with abundant leafroller caterpillar populations (Cornell Lab of Ornithology: All About Birds), and goldenrod, blackberry, or other plants that have thick, tall stems in which most nests are built.

Limitations

Finding habitats via Google Maps proved to be difficult and unreliable. Some of the habitats had changed between the time the aerial photo was taken and when we visited the sites. It was also hard to determine what the habitats were like and if they were upland or lowland from looking on Google Maps and with the lack of soil data of these sites to determine eligibility for Golden-winged Warbler habitat.

Due to our recent introduction to Ornithology, some calls and songs were difficult to identify. Thus, we recorded said calls and songs as 'unknowns'. With the help of Dr. David Ewert, we determined what some of these birds were, although we were still left with some unknowns, similar to the 'other' category in our botany data collection.

Plants at these site were recognized at a variety of precision levels due to a discrepancy in botany knowledge amongst the researchers. At some habitats, specific species were identified and recorded, however, at other sites, families or genera were determined for the main plants.

Acknowledgements

We would like to thank the University of Michigan Biological Station and especially our professor, Dr. David Ewert of The Nature Conservancy, for helping us with the project design

and formatting, and for educating us about Michigan birds. We would like to thank Little Traverse Conservancy for allowing us to research within their preserves.

Appendix 1

Site name, latitude, longitude, vegetation estimate, and number of each bird species recorded at each site. Bird abbreviations are standardized using the American Ornithological Union (American Ornithological Union) codes.

Site	Status	Latitude	Longitude	Vegetation Estimates	Bird Species ¹ and Number of each Species
A	Upland	45°37'22.8"N	84°40'40.8"W	maple 15%, grasses 15%, honeysuckle 68%, white ash 2%	AMRE (2), AMCR (1), YTVI (1), NAWA (1), Unknown (4 different)
B	Lowland	45°36'12.8"N	84°42'42.9"W	iris 5%, grasses 25%, dogwood 5%, sedge 25%, willow 30%, red maple 10%	Unknown Woodpecker (pecking; 1), RBGR (1), NAWA (1), COYE (1), VEER (1), AMCR (1), MOWA (1), BAWW (1), RWBL (1), Unknown (other; 1)
D	Upland	45°34'21.8"N	84°48'49.0"W	bracken fern 30%, trembling aspen 30%, white birch 15%, other 10%	OVEN (1)
E	Upland	45°32'44.9"N	84°47'26.6"W	bracken fern 30%, white birch 15%, cherry 5%, other 10%, beech 30%, maple 10%	OVEN (1), BAWA (1), NAWA (2), ALFL (1)
F	Upland	45°33'28.8"N	84°45'25.2"W	bracken fern 55%, trembling aspen 20%, white pine 15%, red maple 5%, jack pine 5%.	HETH (1), AMRE (2), MYWA (1), Unknown (2 different)

G	Upland	45°34'18.2"N	84°45'19.7"W	bracken fern 10%, other 10%, grasses 10%, white pine 35%, red pine 10%, oak 10%, alder 15%	BCCH (2), REVI (1), CHSP (1), MODO (1), OVEN (1), COYE (1), NAWA (1), Unknown (1)
H	Lowland	45°34'23.4"N	84°44'44.4"W	grasses 20%, alder 15%, other 5%, poison ivy 15%, viburnum 30%, trembling aspen 10%, unknown maple 5%.	WTSP (1), RBGR (1), REVI (1), OVEN (1), GWWA* (1), Unknown (2 of same species, counter-singing)
I	Lowland	45°34'21.6"N	84°43'44.8"W	grasses 30%, alder 25%, other 10%, poison ivy 5%, sugar maple 15%, bracken fern 15%	BLJA (1), VEER (1), AMRE (1), GRCA (1), RBGR (1), YBSA (1)
J	Lowland	45°33'10.8"N	84°40'58.8"W	alder 53%, red maple 1%, marsh marigold 10%, cinnamon fern 10%, oak 2%, horsetail 2%, blueberry 2%, cedar 20%	WAVI (1), NAWA (1), REVI (2), BTNW (1), Unknown (2 different species)
K	Lowland	45°35'42.7"N	84°45'21.6"W	alder 60%, dogwood 2%, sedge 2%, poison ivy 2%, trembling aspen 20%, horsetail 2%, prickly gooseberry 2%, sensitive fern 10%	REVI (1), BAWW (1), RUGR (1), VEER (1), WTSP (1), COYE (1), Unknown Woodpecker (pecking; 1)
L	Lowland	45°33'04.8"N	84°44'58.7"W	iris 1%, grasses 35%, alder 20%,	BHCO (1), ALFL (1),

				balsam poplar 5%, meadowsweet 35%, other 4%,	NAWA (1), WTSP (1), GWWA* (1), YBSA (1)
M	Upland	45°42'14.4"N	84°46'48.0"W	bracken fern 15%, trembling aspen 25%, other 5 %, grasses 5%, white pine 5%, oak 2%, wild sarsaparilla 33%, moss-reindeer lichen 5%, red maple 5%	CEDW (1), OVEN (4), EAPH (1), REVI (2), BLJA (2), AMCR (1), Unknown (1)
O	Lowland	45°26'02.4"N	84°47'27.6"W	other 6%, dogwood 2%, cedar 15%, sensitive fern 15%, white ash 10%, tamarack 30%, red pine 20%, white pine 2%	WTSP (1), NAWA (1), MODO (1), YSFL (1), BAWW (1)
P	Upland	45°34'37.2"N	84°59'24.0"W	bracken fern 5%, other 5%, beech 30%, sugar maple 40%, ironwood 20%	OVEN (1), REVI (2), AMRE (1), BTNW (1), GCFL (1), RBGR (1), NAWA (1), BCCH (1)
Q	Upland	45°26'34.8"N	84°56'02.4"W	other 3%, beech 40%, grasses 5%, red pine 30%, red maple 2%, honeysuckle 8%, raspberries 1%, paper birch 10%, wood fern 1%	WAVI (1), OVEN (2), BCCH (1), REVI (1)
R	Lowland	45°24'54.0"N	84°44'31.2"W	maple 2%, bracken fern 2 %, blueberry 5%, tamarack 10%, leatherleaf 74 %	RWBL (1), CHSP (1), COYE (1), BAWW (1),

				spotted knapweed 2%, white pine 5%	MOWA (1)
S	Lowland	45°40'54.9"N	84°48'24.0"W	grasses 5%, other 6%, dogwood 2%, trembling aspen 2%, cedar 30%, sensitive fern 40%, spruce 15%	REVI (1), BAWW (1), BTNW (1), NAWA (1), AMRE (1), OVEN (1), WTSP (1), Unknown (1)
T	Upland	45°30'36.0"N	84°43'33.6"W	bracken fern 20%, cherry 6.5%, grasses 1%, red maple 5%, white ash 7.5%, balsam poplar 20%, big-toothed aspen 40%	OVEN (2), REVI (1), AMRE (2)
W	Upland	45°37'40.5"N	84°44'25.1"W	bracken fern 30%, trembling aspen 30%, cherry 1%, other 12%, honeysuckle 5%, white ash 1%, balsam poplar 5%, strawberries 10%, raspberries 5%, spruce 1%	REVI (1), OVEN (1), NAWA (1), MYWA (1), AMCR (1), Unknown (1)
Y	Lowland	45°35'25.7"N	84°42'42.7"W	grasses 60%, alder 15%, other 20%, sensitive fern 5%	VEER (1), RUGR (1), SACR (2), WAVI (1), COYE (1), AMRE (2), BAWW (1), ALFL (1), BCCH (1), GRCA (1), Unknown (2 different species)

¹ ALFL: Alder Flycatcher, AMCR: American Crow, AMRE: American Redstart, BAWW: Black-and-white Warbler, BCCH: Black-capped Chickadee, BHCO: Brown-headed Cowbird, BLJA: Blue Jay, BTNW: Black-throated Green Warbler, CEDW: Cedar Waxwing, CHSP: Chipping Sparrow, COYE: Common Yellowthroat, EAPH: Eastern Phoebe, GCFL: Great Crested Flycatcher, GRCA: Gray Catbird, GWWA: Golden-winged Warbler, HETH: Hermit Thrush, MODO: Mourning Dove, MOWA: Mourning Warbler, MYWA: Yellow-rumped Warbler, NAWA: Nashville Warbler, OVEN: Ovenbird, RBGR: Rose-breasted Grosbeak, REVI: Red-eyed Vireo, RUGR: Ruffed Grouse, RWBL: Red-winged Blackbird, SACR: Sandhill Crane, VEER: Veery, WAVI: Warbling Vireo, WTSP: White-throated Sparrow, YBSA: Yellow-bellied Sapsucker, YSFL: Northern Flicker (Yellow-shafted), YTVI: Yellow-throated Vireo.

Literature Cited

American Ornithological Union. http://www.wec.ufl.edu/birds/SurveyDocs/species_list.pdf
Accessed 14 June 2016.

Ambrose III, H.W. and K.P. Ambrose. 1987. A Handbook of Biological Investigation, Fourth Edition. Hunter Textbooks, Winston-Salem, North Carolina

Cornell Lab of Ornithology. All About Birds.

https://www.allaboutbirds.org/guide/Golden-winged_Warbler/lifehistory Accessed 28 May 2016.

eBird. Range Map. <http://ebird.org/ebird/map/> Accessed 11 June 2016.

Golden-winged Warbler Working Group. Conservation Plan. <http://www.gwwa.org/plan.html>
Accessed 28 May 2016.

Golden-winged Warbler Working Group. Executive Summary. <http://gwwa.org/ecology.html>
Accessed 11 June 2016.

Golden-winged Warbler Working Group. Golden-winged Warbler Habitats in the Great Lakes Region. http://gwwa.org/resources/GWWA-GLRegionalGuide_130808_lo-res.pdf Accessed 14 June 2016.

Michigan Breeding Bird Atlas I & II. Golden-winged Warbler.

<http://mibirdatlas.org/Portals/12/MBA2010/GWWAcompare.pdf> Accessed 13 June 2016.

Michigan Breeding Bird Atlas. Appendix 3: Comparison of Township totals from MBBA I to MBBA II.

<http://www.mibirdatlas.org/Portals/12/MBA2010/Appendix3.pdf> Accessed 13 June 2016.

Michigan Department of Natural Resources. Mi-HUNT. <http://www.mcgi.state.mi.us/mi-hunt>
Accessed 28 May 2016.

National Audubon Society, Audubon Bird Guide: North America. 2011. Version 7.5.1.
www.audubonguide.com

National Park Service. Herbaceous Forbs.

<https://www.nps.gov/plants/alien/pubs/midatlantic/cestm.html> Accessed 11 June 2016.

Northeastern Area State and Private Forestry. Forest Invasive Plants Resource Center.
<http://na.fs.fed.us/spfo/invasiveplants/factsheets/pdf/bush-honeysuckle.pdf> Accessed 11 June 2016.

United States Department of Agriculture. Plant Guide.
http://plants.usda.gov/plantguide/pdf/pg_soca6.pdf Accessed 13 June 2016.