Golden-winged Warbler Reproductive Success and Habitat Assessment on Utility Rights-of-way

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Status of the Species

The golden-winged warbler (GWWA) is currently listed as special concern in New Jersey, but has recently been voted via the Delphi process to be escalated to threatened. In New Jersey, GWWAs only breed in the northwestern part of the state (Ridge and Valley and Southern New England physiographic provinces), with the highest density (92%) in the Highlands region (Benzinger 2000 and 2001). From the Breeding Bird Survey (BBS) data and analyses, the population of this species has been declining by 9.9 in the Ridge and Valley region (1980-2004) and was declining 20.7 in the Southern New England region (1966-2004), but no trend can be estimated for 1980-2004 due to a lack of observations on the BBS routes.

Partners in Flight (PIF) considers the GWWA as a species of high continental concern, meaning that conservation in this region is critical to the overall health of the species (Rosenberg and Robertson 2003, Dettmers and Rosenberg 2000). Discussions by experts at the Golden-winged Warbler Conservation Workshop held August 2005 in Wisconsin revealed multiple possibilities for the decline of this species: loss of breeding habitat, loss of wintering habitat, genetic introgression and competition with blue-winged warblers, and global warming.

Summary of Other Research

Breeding habitats selected by GWWAs are highly variable. Results of a 2000-2001 Golden-winged Warbler Atlas Project (GOWAP) in New Jersey revealed that NJ had approximately 90 breeding pairs, mostly in utility rights-of-way (ROW) (42%) and shrub swamps (42%), and none observed in strip mines or abandoned homesteads (Benzinger 2000 and 2001). This differs from the results of Cornell's GOWAP summary by region, which states that GWWAs in the Mid-Atlantic Highlands (northern West Virginia to southern New York) use mostly shrubby fields and successional forests, and also some wetland alder swamps (24%) and utility ROWs (15%) (Barker Swarthout and Rosenberg 2005).

There are some studies that have looked at the effects of habitat on productivity. Kubel (2005) found that utility ROWs had higher predation rates than clearcuts, especially when the ROWs are within 1 km of the agriculture. However, there are few clearcut sites (2%) in New Jersey used by GWWAs (Benzinger 2000 and 2001) and, based on 2002 land use/land cover, only 0.03% of the area within 1 km of the study sites is in agriculture (See Appendix A). In southern New York, Confer (pers. comm.) demonstrated that GWWAs had higher nesting success in areas where blue-winged warblers (BWWA) do not occur, but "the margin of significance for these conclusions is tiny and could be refuted by a single year's data so that further testing verification of this would be quite significant for conservation planning".

Confer *et. al* (2003) has shown that GWWAs chose areas with a mean 69% herbaceous cover, which was different from BWWA's preference of a mean 60% herbaceous cover. Within our study sites, the mean herbaceous cover of all territories was 30% with only one territory greater than 60%. Confer (2003) also discovered that tree cover and herbaceous cover had negative effects on fledging success, but herbaceous and shrub cover was positively correlated with clutch size, and more recently (pers. comm.) that territories in swamp forests have higher nesting success than uplands (0.703 vs. 0.408).

Justification

This research is being conducted to determine the characteristics of source habitat for GWWAs occupying utility ROWs in New Jersey. This study is particularly necessary in New Jersey because (as stated above) the areas GWWAs occur in New Jersey do not fall into the same landscape context of studies in central PA and the habitat chosen appears to differ from habitat selected in studies in southern NY.

There are two options to reverse the decline of GWWAs in New Jersey, protect their habitat from being destroyed, and/or enhance their habitat to increase productivity. Based on GWWA breeding density (Benzinger 2000 and 2001), there are two useful places to take these approaches, utility ROWs and swamp forests. As 42% of the known GWWA locations in New Jersey occur in utility ROWs, it makes simple economic sense to target ROWs for habitat enhancement. Utility ROWs are already managed continuously, so the opportunity exists to have utility companies alter management techniques on their ROWs to create source habitat for GWWAs.

There are numerous ways to enhance habitat for GWWAs, including altering management practices (increasing nesting and/or foraging areas or reducing impact on nesting), controlling for predators (reducing nest predation), and increasing food supply (increasing clutch size and fledgling success). Care needs to be taken when prescribing habitat characteristics in order to avoid the creation of habitat sinks as there is a lack of information about the characteristics of source habitat on utility ROWs. In fact, the Golden-winged Warbler Working Group (GWWWG) has recently stated that research on source habitats in general is needed, specifically in the northeast

and Appalachian region where the population is suffering the steepest declines (Canterbury pers. comm., Barker Swarthout pers. comm.). Confer noted that "management recommendations must be based on statistically documented nesting success specific to habitat types [and] smaller samples will be very lucky to show any statistically meaningful result" (pers. comm.).

Simply stated, more data could likely be the difference between 42% of New Jersey's GWWA population being in a source or sink habitat.

Summary of Methods

The design of this research was done with the guidance and training (nest-searching and habitat measurements) of John Confer of Ithaca College, who has been conducting research on GWWAs for over a decade. Nine possible parameters were gathered to aid in determining the characteristics of source habitat on utility ROWs (Table 1). In order to collect all pieces of information to assign to habitat characteristics, GWWAs were color-banded and spot-mapped to determine territories, nests were located and monitored to determine success rates, and BWWAs and other species were documented and mapped to determine interspecific competition. Nests of other species were also located and monitored to gain a better understanding of what was happening on the ROWs. Habitat characteristics were analyzed separately using a non-parametric ANOVA and Pierson's correlation in SAS version 9.1.

Summary of Results

Twenty-eight territories of 23 GWWA males were delineated 2003-2005. All habitat characteristics within territories, except shrub cover, differed from those characteristics measured outside of territories, but there was no strong correlation with the characteristics and habitats chosen (Tables 2 and 3). However, all of the variables in a territory differed from other territories, all variables, except dead cover, within territories differed among years (Table 3), and all variables within territories differed among study sites, even within years.

Nineteen GWWA nests from 14.5 pairs (at least one parent GWWA) were located and monitored 2003-2005. The average clutch size was 4.65 and productivity for GWWAxGWWA pairs was 1.57 (1 is even) (Table 4). All variables within territories, except dead cover, differed between successful and unsuccessful nests, and the strongest correlation for nesting success was with BWWA presence (Tables 4 and 5). All habitat characteristics but dead cover varied among GWWA territories, BWWA territories, and areas where both species occurred (Table 6). However, all variables within territories of successful nests, except herbaceous cover, differed among year, and all variables within territories of successful nests, except vegetation height, differed among site.

Conclusions

Because of the variation within GWWA territories among years and sites, I believe we cannot accurately define the characteristics that GWWAs choose as territories or the characteristics that correspond with successful nests, even though there are statistical differences. Furthermore, I believe habitat measurements from 23 independent territories and 14 independent nests are not adequate sample sizes to accurately depict source habitats, regardless of the amount of variation. However, based upon 19 nests, GWWAs had positive productivity on the utility ROW and so I can conclude that, in terms of nesting success, the study sites were not habitat sinks for this species. This conclusion may differ when accounting for hybridization with blue-winged warblers, but genetic introgression was not something I was able to measure. With the strong negative correlation with BWWAs and GWWA nesting success, however, it appears as though BWWA are detrimental to GWWA nesting success without taking into account genetic introgression.

Discussions and Recommendations

Reasons for differences in the habitat characteristics among years are unknown at this time. Although there was some management done during the breeding season of 2004, variations still occurred within sites where no management was done. Variations among sites, however, can be explained by the use of different management treatments and when the management was done. Even so, it has been documented that GWWAs have certain habitat preferences (Confer *et. al* 2003) and the assumption was that habitat preferences would be consistent among sites and years. There may be better methods of statistical analyses that will handle variation in habitat characteristics, so a statistician will be consulted for further analyses.

Confer (pers. comm.) recommended, based on his studies, creating habitat patches where we can isolate GWWAs from BWWA populations, which agrees with these results. However, the preference of habitat between GWWAs and BWWAs does not agree with Confer's (2003) differences in herbaceous cover between GWWAs and

BWWAs. I am open to suggestions as to how to tweak this research to get better data, but I am convinced that this research needs to continue in order to prevent the species from further population declines New Jersey.

I recommend that we continue this research. Although we have three years of data, the numbers are not substantial for statistical analyses, and continuing this research will provide us with more data that may help determine source habitats on ROWs. Furthermore, other states and provinces are now beginning to show interest in researching and managing for GWWAs and a coordinated effort with potential funding is underway. It was recommended that decisions for delegating funding should take into to account areas with prolonged studies because of the cumulative data base is more likely to yield meaningful results (Confer pers. comm.). Because we are ahead of most other states in terms of GWWA research, it would be in our best interest to continue this study and be among the leaders in a coordinated continental effort.

Table 1. List of variables assigned to the habitat circles

Variable	**Measurement**	**Definition**
Herbaceous Cover	0,25,50,75,100	% of area in circle covered by herbaceous vegetation
Shrub Cover	0,25,50,75,100	% of area in circle covered by woody vegetation less than 3.3 m tall
Tree Cover	0,25,50,75,100	% of area in circle covered by woody vegetation greater than 3.3 m tall
Dead Cover	0,25,50,75,100	% of area in circle covered by dead vegetation
Vegetation Height	Meters	Maximum height of vegetation in circle
Wetland	0,1	Whether circle was upland (0) or wetland (1)
BWWA	0,1	Whether circle coincided with blue-winged warbler presence
Occupied	0,1	Whether circle was part of golden-winged warbler territory
Success	y,n,u or 0,1	Whether circle was part of territory of successful golden-winged warbler nest (assigned to territory circles only)

Table 2. Summary and comparison of habitat characteristics and BWWA presence within golden-winged warbler study sites

	Territory		**Non-territory**			
	Mean	**SE**	**Mean**	**SE**	**Chi-square**	**P-value**
% Herbaceous Cover	30	0.008	33	0.006	6.59	0.01
% Shrub Cover	25	0.008	24	0.006	NS	NS
% Tree Cover	21	0.009	18	0.006	5.60	0.018
% Dead Cover	12	0.005	11	0.004	4.93	0.026
Vegetation Height (m)	6.10	0.206	5.26	0.144	21.36	<0.001
% Wetland Sites	10.4	0.008	5.6	0.005	30.16	<0.001
% BWWA	43	0.013	38	0.013	5.23	0.022

Table 3. Correlation analyses of habitat characteristics and blue-winged warbler presence with year, golden-winged warbler territories, and golden-winged warbler nesting success

	Year	**Territory**	**Success**
Herbaceous Cover	**0.175**	-0.043	**-0.096**
Shrub Cover	**-0.057**	**0.028**	**0.146**

Tree Cover	**-0.175**	0.05	**0.125**
Dead Cover	0.006	**0.039**	-0.008
Vegetation Height	**-0.155**	**0.053**	**0.107**
Wetland	**0.097**	**0.090**	-0.094
BWWA	**-0.043**	**0.044**	**-0.370**

*Numbers in bold have a p-value <0.05

Table 4. Summary of site information and golden-winged warbler productivity for GWWAxGWWA pairs

	Area (ha)	# Years Surveyed	Total # Territories	# Nests	% Successful	Mean Clutch Size	Productivity	# BWWA
Sparta North*	19.2	3	13	7	29%	4	0.80	5
Sparta East	10.5	1	2	0	n/a	n/a	n/a	1
Edison Swamp**	1.2	3	3	2	100%	6	2.50	0
Sparta South*	16.2	2	2	0	n/a	n/a	n/a	10
Weldon Brook*	19.8	2	2	2	0%	4.15	0	28
Pequannock	9.0	1	5	4	75%	5	1.88	7

* Site consists of 2 parallel adjacent spans
** Site is a swamp forest adjacent to small ROW

Table 5. Summary and comparison of habitat characteristics within golden-winged warbler territories

	Successful		Unsuccessful			
	Mean	**SE**	**Mean**	**SE**	**Chi-square**	**P-value**
% Herbaceous Cover	28	0.014	34	0.017	10.46	0.001
% Shrub Cover	37	0.015	27	0.015	11.91	<0.001
% Tree Cover	25	0.016	17	0.016	10.28	0.001
% Dead Cover	9	0.008	10	0.010	NS	NS
Vegetation Height (m)	7	0.363	5.32	0.417	14.34	<0.001
% Wetland Sites	13	0.015	20	0.023	6.87	0.009
% BWWA	44	0.023	82	0.022	104.63	<0.001

Table 6. Summary and comparison of habitat characteristics between GWWA territories, BWWA territories, and areas that contain territories of both species

	GWWA Only		Both		BWWA Only			
	Mean	**SE**	**Mean**	**SE**	**Mean**	**SE**	**Chi-square**	**P-value**
Herbaceous Cover	29	0.010	33	0.012	38	0.013	31.99	<0.001
Shrub Cover	26	0.010	24	0.011	27	0.012	7.59	0.022
Tree Cover	24	0.012	16	0.011	14	0.011	26.04	<0.001
Dead Cover	12	0.006	12	0.008	12	0.008	NS	NS
Vegetation Height	6.8	0.290	5.21	0.283	4.9	0.272	18.11	<0.001
Wetland	7.9	0.009	13.7	0.014	7.3	0.012	17.8	<0.001

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Personal Communications:

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Canterbury, R., professor at University of Cincinnati. Email communication written to the Golden-winged Warbler Working Group Coordinating Committee listserve on March 17, 2006.

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Appendix A. Number of acres of 2002 Land Use/ Land Cover level 3 categories within 1 km of all GWWA study sites in NJ

Land Use Classification (2002)	Number of Acres	% of Area
Deciduous forest (>50% crown closure)	4813.952	58.00%
Deciduous wooded wetlands	803.057	9.68%
Mixed forest (>50% coniferous with >50% crown closure)	549.246	6.62%
Upland rights-of-way undeveloped	317.447	3.82%
Mixed forest (>50% deciduous with >50% crown closure)	255.989	3.08%
Artificial lakes	246.342	2.97%
Residential, single unit, low density	220.009	2.65%
Deciduous scrub/shrub wetlands	213.286	2.57%
Residential, rural, single unit	179.889	2.17%
Deciduous forest (10-50% crown closure)	136.180	1.64%
Residential, single unit, medium density	76.210	0.92%
Major roads	74.420	0.90%
Mixed wooded wetlands (Deciduous dom.)	55.194	0.66%
Wetland rights-of-way	44.133	0.53%
Mixed forest (>50% deciduous with 10-50% crown closure)	38.151	0.46%
Coniferous forest (>50% crown closure)	32.149	0.39%
Mixed scrub/shrub wetlands (Coniferous dom.)	28.972	0.35%
Mixed forest (>50% coniferous with 10-50% crown closure)	25.566	0.31%
Commercial/Services	25.198	0.30%
Mixed scrub/shrub wetlands (Deciduous dom.)	23.357	0.28%
Transitional areas	21.899	0.26%
Herbaceous wetlands	18.772	0.23%
Phragmites dominate interior wetlands	13.252	0.16%
Other urban or built-up land	11.974	0.14%
Recreational land	11.667	0.14%
Coniferous wooded wetlands	10.901	0.13%
Natural lakes	10.678	0.13%
Old field (<25% brush covered)	10.667	0.13%
Streams and canals	6.646	0.08%
Deciduous brush/shrubland	5.984	0.07%
Disturbed wetlands (modified)	3.922	0.05%
Transportation/communication/utilities	2.990	0.04%
Cropland and pastureland	2.326	0.03%
Coniferous forest (10-50% crown closure)	2.288	0.03%
Residential, high density or multiple dwelling	1.712	0.02%
Undifferentiated barren lands	1.166	0.01%
Stormwater basin	1.066	0.01%
Plantation	0.961	0.01%
Cemetery	0.886	0.01%
Managed wetland in built-up maintained rec area	0.818	0.01%
Managed wetland in maintained lawn greenspace	0.478	0.01%
Mixed deciduous/coniferous brush/shrubland	0.380	0.00%
Bridge over water	0.018	0.00%