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Bee and Wasp Species Diversity at a Restored Wetland in Seneca Falls, New York

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by

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ABSTRACT

When monitoring the health and any changes in an ecosystem, having a baseline of species present in the area is important to be able to monitor changes over time. I was interested in the bee and wasp species richness at the Seneca Meadows Wetland Preserve in Seneca Falls, New York as it is a five year old restored wetland with a diverse range of habitat types. I hypothesized that the esker habitat, at the crux between wetland and upland habitat would have the greatest species richness. Using cup traps and sweep netting, I obtained and identified specimens from five major wetland types observed at the wetland. I found a total of 34 bee and wasp species, but could not detect any significant differences between habitat types.

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AKNOWLEDGEMENTS

I would like to first and foremost thank Bill Shields and the ESF Honors Program for his assistance with this project, both in fleshing out the details as well as lending supplies. I would like to also extend my appreciation to the folks at the Seneca Meadows Landfill and Montezuma Audubon for allowing me to tramp across their wetland, as well as Ben Zimmerman for keeping an eye out for a couple of rogue solo cups. Lastly I'd like to thank my parents, Ron and Lydia Green for introducing me to this wetland and keeping me interested in the identification leg of this project when cabin fever began to set in.

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INTRODUCTION

As plant pollinators, bees and other insects are critical in ecosystems to maintain diversity and plant presence (Moroń et al. 2008). Their labor benefits not only natural systems, but human ones as well. Modern, large-scale industrial farms would not be possible without the honey bee, *Apis mellifera*. It has been estimated that these managed bees are responsible for between $1.6 and $5.7 in annual gains in the United States (Southwick and Southwick 1992). Recent exploration into the pollination provided by native bees indicate that they are responsible for more than expected, and that with recent declines in honeybee colonies due to colony collapse disorder (CCD), they may play a more important role than previously considered in modern agricultural practices.

In a recent analysis of pollination requirements for crops species around the globe, it was found that 87% of fruits, seed and vegetable producing crops require animal-mitigated pollination (Klein et al. 2007), and that this represents 30% of global food production. Of the major global crops, 42% were found to be pollinated by at least one native species of bee (Klein et al. 2007). In the New York apple industry, because apples must be cross-pollinated it is the pollinators that are the limiting resource (Asher and Gardner 2006), and with over 400 species of bee in New York there is potential for these species to pick up honey bee slack. While native bees may play an important role in crop pollination, like the honeybee, there are reports that their populations are declining in North America, Austria, Russia and other European countries (Moroń et al. 2008). While many factors are at cause, it is believed that these declines are primarily caused by habitat fragmentation and loss, intensification of agricultural processes and use of chemicals including pesticides and herbicides by large farms and homeowners (Cane and

Tepedine 2001). Because of the role these species play in our ecosystems, their loss would cause catastrophic conditions and would not be contained to the “wild” ecosystems they are from.

Not surprisingly, wetlands have been found to be critical habitats for native bees and wasps. They have a wide variety of food sources, but also provide shelter and other resources necessary for successful reproduction and survival. One of the most important aspects of wetlands is the diversity of habitats contained therein, and this has been found to have a positive relationship with species diversity. For much of the history of the United States, wetlands have been destroyed for health, agriculture and aesthetic reasons. In New York alone, even as recent as 1981, wetlands in the Great Lakes Basin were being destroyed as much as 20,000 acres per year (Fish and Wildlife Service 1986).

However, with international concern over wetlands that sparked the first MAR Convention of 1962, there has been an increase of awareness and knowledge regarding the importance of wetlands and the roles they play, and especially how these affect human systems and how people might be benefitted by wetland presence. These benefits include habitat for wildlife, water filtration, natural protection along the coasts and food and resource sources for humans. More recently, wetlands have been restored not only by conservancies and non-profit organizations such as the Audubon Society, but by companies themselves to mitigate any new damages they cause wetlands. While some scrape by creating ponds, others go well above and beyond the minimum mitigation effort.

One such company is the Seneca Meadows Landfill in Seneca Falls, New York. Just off of route 414, the landfill needed to expand 70 acres into a neighboring swamp.

Required by New York State, law, this action required mitigation effort of at least a 1:1 replacement of the wetland lost. The landfill acquired several hundred acres of farm land on the opposite side of route 414 and mitigated the 70 acres of original acres lost with over 700 acres in the new location.

This project was initiated in 2008, and most of the intensive landscape changes were finished in a year. Fields were then seeded and over the next several growing seasons, invasive species were managed and native species planted. In the last three years there have been vegetation and amphibian surveys, and I was interested in learning more about the bee and wasp species present because of their ecological importance.

I hypothesized that the esker habitat would have the greatest bee and wasp diversity as it is more upland type than any of the other main habitats at the wetland complex. Bees have been found to prefer drier habitats and it is believed that this is due more because of food specialization than available nesting habitat (Bartholomew and Prowell 2006, Moroń et al. 2008).

METHODS

Data were collection from the Seneca Meadows Wetland Complex in Seneca Falls, New York in Seneca County. This location was chosen for its diverse range of wetland habitats that included forested, emergent and more upland landscape, as well as my familiarity with it. At the time of the data collection, the wetlands were three years old and a year had passed since any major change occured. In 2012 the complex was put in charge of the Audubon Society.

Using plant community maps, we determined there were five significant habitats at the preserve. These were wet prairie, wet marsh, esker, oak savannah, and existing forested wetland. Emergent communities were not included due to difficulty of access and lack of resources utilized by subject Hymenoptera. Created forested wetlands were also not included because the trees were very young and this habitat type did not cover a large area of the wetlands. We only had one long transect per habitat type instead of several each because of the size of the wetlands and the time it took to traverse between these sites.

Bees and wasps were collected using two common techniques; sweep netting and pan traps (Dillon 2010). We used UV reactive white solo cups and painted one third of them UV reactive blue, and another third UV reactive yellow. I collected on 30 May, 6 and 14 June, 2 and 14 July, and 1 and 14 August, 2012 for 8 hours each day.

Starting at 8am, 15 solo cups (5 of each color) were set out 10 meters apart along the five transects in an alternating pattern. Each was filled two-thirds of the way full with a soapy water solution. I used Dawns lavender scent in each mixture throughout the sampling season. These cups were left out for eight to nine hours each sampling day. At each site I collected weather data including air temperature, humidity and wind speed.

At noon each site was visited and I sampled with the net. I spent 20 minutes meandering within the habitat range at each site. All captured bees and wasps were put in a kill jar until the end of the timed meander, when they were moved to a labeled jar until pinning. Due to the length of time required for this, to stay on schedule, I collected weather data (air temperature, humidity and wind speed) at a centralized location. Any obvious differences observed at any sites were recorded.

Between 4 and 5 in the afternoon, I collected the solo cups. Any bee, wasp or suspected bee or wasp were collected in a bag labeled with the site and cup color and stored in alcohol. Non-target species and the remaining soapy water were discarded. After collecting the cups from each site, I recorded the air temperature, humidity and wind speed.

The same day of collection, I cleaned the collected specimens with warm, soapy water and a hair dryer. They were then pinned and labeled with the data collected, habitat type and solo cup color. If a specimen had been caught with the net, they were marked with an “N.” If I didn’t have time to pin that night, specimens were frozen until a later date.

Individuals were identified to species if possible using a dissecting scope. If the species was unknown, the most specific term was used and given an identifying letter, e.g. Vespoidea A. Descriptions were kept with these species descriptors to avoid giving a species more than one identifier.

Species lists and numbers were organized by date collected, collection habitat and cup color. Using Microsoft Excel, I found the average number of individuals and species found by collection date, habitat type and cup color. We used T-tests to examine and compare between sites and cup color.

RESULTS

Over the course of the summer, I caught 373 individuals of 34 species (Table 1). The number of individuals caught had two peaks; one in early June and then again in early July (Figure 2). The spike in June was due primarily to the Esker transect, and the August peak to the Wet Prairie transect. These two habitats had the overall highest average number of individuals captured. The esker habitat averaged 22.57 individuals (SD= 20.36), and the wet prairie averaged 23.7 individuals (SD= 18.55) captured; these data are the sum of individuals captured using sweep nets and pan traps . The highest number of species didn't follow this pattern; the greatest number of species were caught in early June, but after this sampling day, the number of species caught per habitat didn't peak or valley much (Figure 3). This trend however appeared to have an overall decreasing pattern, but this was only weakly supported with an R^2 value of 0.33. There were no significant differences in number of species captured between habitat types (ANOVA F= 0.94 , p= 0.45).

Because I used the three colors of solo cups and kept the individuals caught in each separate, I was able to examine any differences in capture rates due to bowl color (Table 2). I found no significant differences between color used and number of species captured. On average, the blue solo cup captured 1.68 species, the yellow 1.86 species and the white 1.8 species each sampling day. An ANOVA test found a critical f value of 3.08, but these data only had an f value of 0.15 signifying no significant difference.

With 132 individuals caught, *Halictus ligatus* made up 35.39% of the entire collection. The top five species caught; *Halictus ligatus, Lassioglosum achillae, Apis mellifera, Augochlora pura,* and *Hylaeus annulatus* made up 75.87% of the total collection.

DISCUSSION

As no significant differences occurred between the number of species found or the number of individuals caught among the five major habitat types, it is important to consider possible reasons for this and implications for any future studies. First and foremost is the fact that the Seneca Meadows Wetland Preserve is still a young wetland. At three years old at the time of sampling, there may not have been enough time for species to differentiate more between habitats, and all species in the surrounding area may not have reached the wetland and found it suitable. Younger mitigated wetlands tend to have greater plant species richness and diversity than original wetlands. However, this is often due to the presence of more pioneer species and non-native plants that may take over (Balcombe et al. 2005); this may occur because lack of native predators and the rapid reproduction of these kinds of species. The wetland seen today will look very different from the one that will be seen in even just a few years, and as the wetland matures and ages, the bee and wasp compositions will change along with the plant communities.

A couple of studies have been focused on bees in the Finger Lakes region of upstate New York, but these were surveys trapping specimens using trap nests (O'Neill and O'Neill 2010, 2013). Because of differences in sampling methods, where O'Neill and O'Neill found more nesting wasps, I found more feeding bees; although specimens of *Hylaeus annulatus* (family: Colletidae) were found in all studies. Dillon (2010) captured 165 species of non-social bees and wasps at the Three Rivers Wildlife Management Area in Clay, New York. This was done over a two year period utilizing sweep nets, pan traps and nest traps. While the number of species I captured was much lower, the capture pattern is similar as we both found the greatest number of species in late May/ early June and the overall trend after that was a decreasing number.

The vast size and my limited modes of travel restricted me to only having one transect for each habitat type, and all were in the northern half of the preserve. Should this study be repeated, any different results from utilizing the whole wetland and not being limited by self-propelled forms of traversing between sites, or so few transects. The habitat types aren't homogenous across the landscape and there are subtle differences between them depending on one's exact location, and had I been able to cover more of the wetland complex, I may have been able to capture more of the diversity present, assuming it is there. However, this was merely a base study for others to hopefully build on and use as a guide of what is known to be at this preserve and likely the surrounding area as well.

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APPENDICES

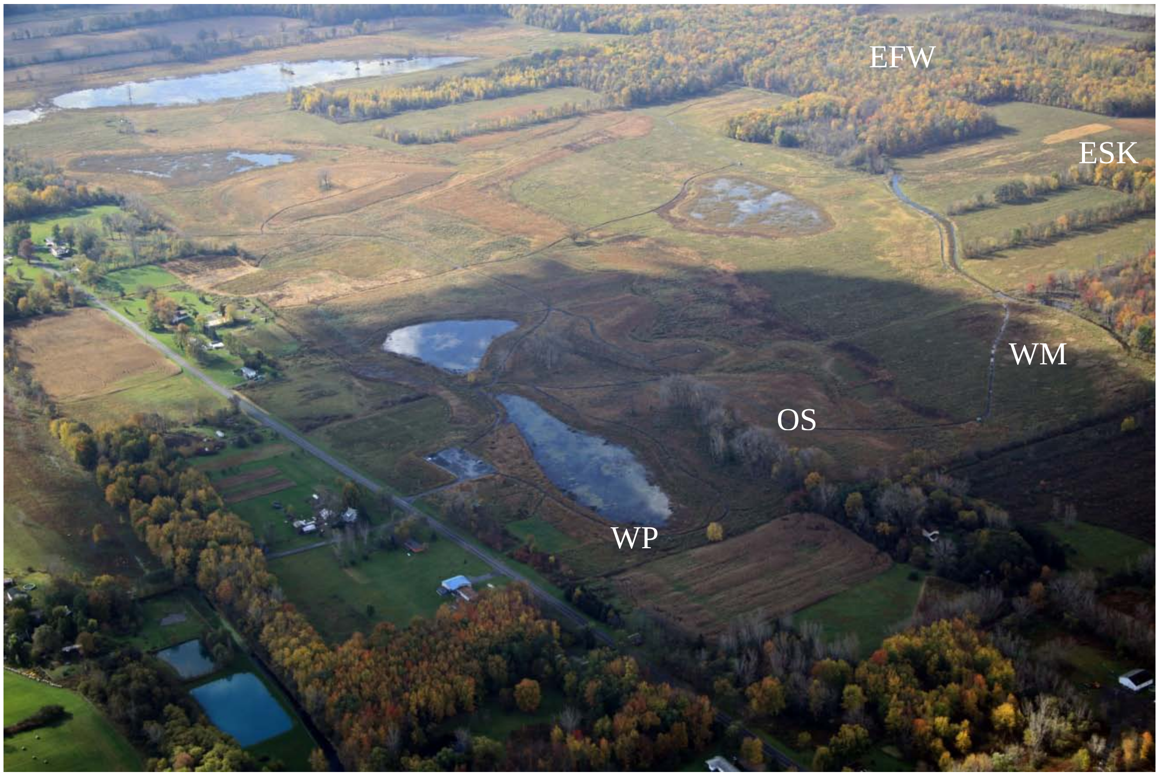

Figure 1. Map of the Seneca Meadows Wetland Preserve with transects labeled. Photo courtesy of Seneca Meadows landfill; photo by Dave Duprey.

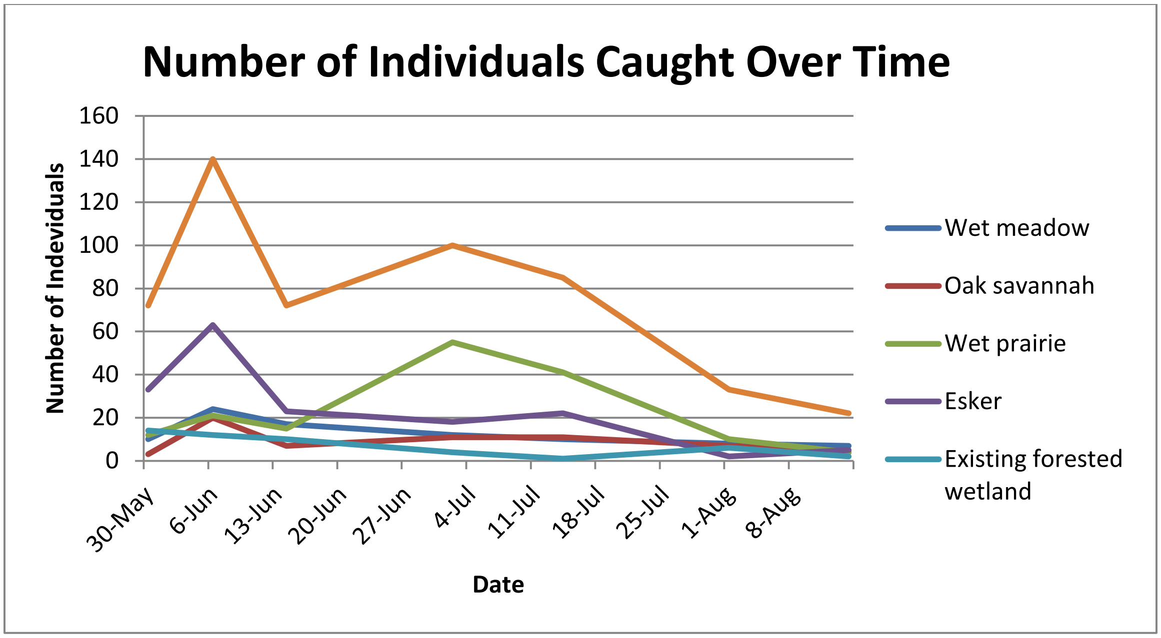

Figure 2. Number of individuals caught over time from each habitat, including a total count for each sampling day (topmost, orange line). The number of individuals is the sum of those captured with sweep nets and pan traps.

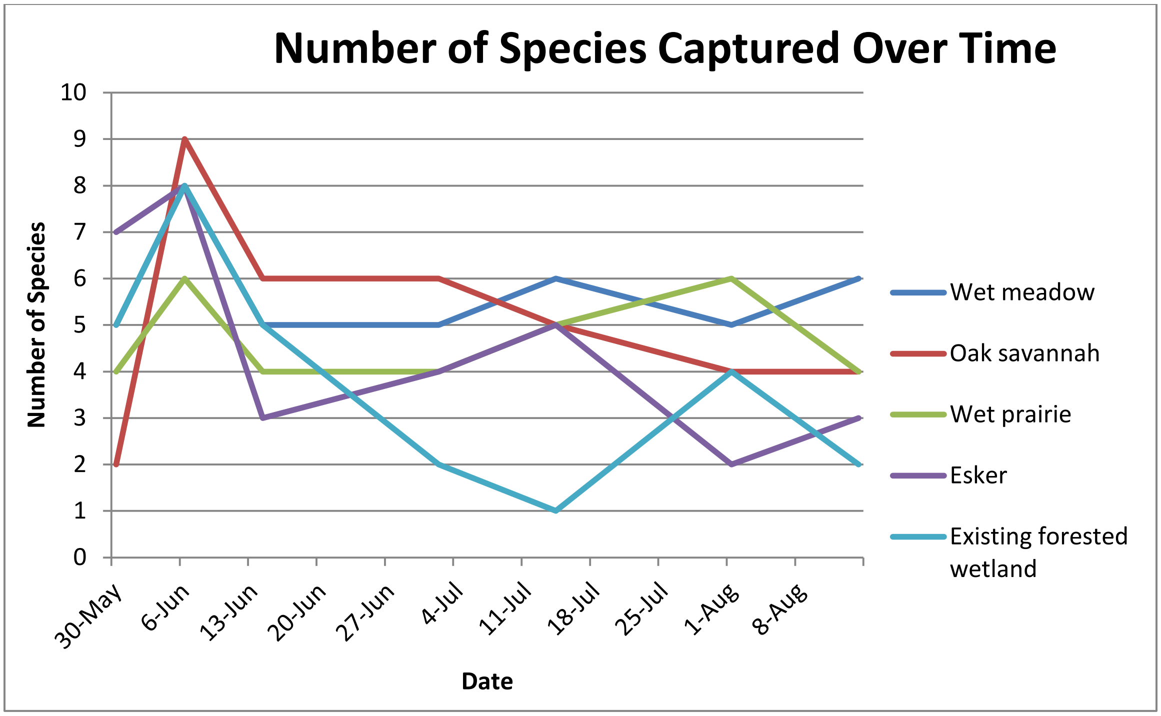

Figure 3. Number of species caught for each sample day. The number of species is the sum of those caught with sweep nets and pan traps.

Table 1. Bee and wasp species caught in all habitats, from both cup traps and sweep netting over the course of the sample season.

All species found at Seneca Meadows Wetland Complex
Agapostemon virescens
Apis mellifera
Augochlora pura
Bombus bimaculatus
Bombus impatiens
Chrysidoidea A
Colletidae americanus
Colletidae hyalinus
Halictus ligatus
Hylaeus annulatus
Ichneumonidae A
Ichneumonidae B
Ichneumonidae C
Ichneumonidae D
Ichneumonidae E
Ichneumonidae J
Ichneumonidae K
Lassioglosum achillae
Lassioglosum leiuessimun
Nomada pygmaea
Nomada sayi
Polistes dominula
Tenthredinidae A
Tenthredinidae B
Unknown 1
Unknown 2
Unknown 3
Unknown Vespoidea
Vespoidea A
Vespoidea B
Vespoidea C
Vespoidea D
Vespoidea E
Vespoidea F

Table 2. Bee and wasp species caught by blue, white and yellow pan traps over the course of the sample season. Species marked with an asterisk denote a species caught unique to that color.

White	Blue	Yellow
Augochlora pura	*Augochlora pura*	*Augochlora pura*
Apis mellifera	*Agapostemon virescens*	*Agapostemon virescens*
Colletes hyalinus	*Apis mellifera*	*Apis mellifera*
*Colletes americanus**	*Colletes hyalinus*	*Chrysidoidea sp.**
Hylaeus annulatus	*Hylaeus annulatus*	*Colletes americanus*
Halictus ligatus	*Halictus ligatus*	*Hylaeus annulatus*
Ichneumonidae A	Ichneumonidae A	*Halictus ligatus*
Ichneumonidae C	Ichneumonidae C	Ichneumonidae A
Ichneumonidae D	Ichneumonidae D	Ichneumonidae B*
Ichneumonidae E	Ichneumonidae E	Ichneumonidae C
Lassioglosum achillae	Ichneumonidae K*	Ichneumonidae D
Lassioglosum leiuessimun	*Lassioglosum achillae*	Ichneumonidae E
*Nomada sayi**	*Lassioglosum leiuessimun*	Ichneumonidae J*
Unknown 3*	Unknown 1*	*Lassioglosum achillae*
Vespoidea A	Vespoidea A	*Lassioglosum leiuessimun*
Vespoidea B	Vespoidea B	*Nomada pygmaea*
Vespoidea D*	Vespoidea C*	Unknown 2*
Vespoidea E*	Vespoidea F	Vespoidea A
Vespoidea I*		Vespoidea B
Vespoidea F		Vespoidea F
		Tenethrinidae 1*