Comparing harvestmen species composition between habitats on Nantucket Island, Massachusetts

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Abstract

From 2006 through 2008, we collected surface invertebrate specimens using pitfall traps from a variety of habitats on Nantucket Island and Tuckernuck Island, Massachusetts. In this project, we sorted 413 harvestmen from these samples, identified all specimens to species, and compared species distributions within four general habitat types. We identified all four species that appear on a historic species list from the late 1920's and we added the non-native species *Phalangium opilio*. We found that *H. maculosus* prefers open heathland habitat over dense heathland and tupelo forest. Other species showed no significant preference for a specific habitat. We continue to sort specimens.

Introduction

Harvestmen (Arachnida, Opiliones) are the third-largest and among the oldest group of arachnids in the world (Pinta-da-Rocha *et al* 2007). Nantucket Island, Massachusetts, is 26 miles south of Cape Cod and has seen drastic changes in vegetation over the last half century (Motzkin et al. 1996). These changes may have affected the species composition of harvestmen. In the late 1920's, James Emerton identified four Harvestmen species on Nantucket Island: *Hadrobunus maculosus, Leiobunum ventricosum, Leiobunum formosum,* and *Leiobunum vittatum* (Johnson 1930). The purpose of our was to use previously collected arthropod samples to compile a new species list for the island. We also were interested in comparing harvestmen diversity to habitat. Harvestmen show high endemicity on a landscape level and very specific moisture requirements on a microhabitat scale.

Methods

Collecting

We sorted harvestmen from previously collected pitfall traps spanning several years and several different projects. The number of traps and the trap interval varied between sites. These traps consisted of eight-ounce canning jars with a funnel hot-glued to the screw-on tops. Each trap was buried so the lip of the funnel was flush with ground level and was covered with some type of rain cover (ranging from aluminum foil sheets, to strips of black plastic). We used propylene glycol mixed with water in a 50:50 ratio in the traps. Dr. Bob Edwards suggested this design as it is what he uses on Cape Cod for his collections (pers. comm. 2006). These pitfalls were set out sporadically during the summers of 2006, 2007 and 2008, for at least three days each interval. We opportunistically collected some specimens by hand in 2010.

Site descriptions

We categorized the trap sites into four general habitat types based on vegetation, vegetation height and visual inspection. Open heathland consisted of sites with vegetation below one meter high with areas of shrubs interspersed with grassland and dispersed trees. Dense heathland consisted of sites predominated by heath shrubs, many over one meter in height, with few open grassland areas. Sites located in dunes were categorized as dune habitat. We had one site in a tupelo forest (approximately

10-15 meters in height) and labeled this as Tupelo forest. We also collected from a variety of habitats on Tuckernuck Island and from residential areas on Nantucket, though these specimens were not included in habitat analysis.

Dune Habitat:

Eel Point 2- The plot straddles the interface between protected inner dunes to the south with shrubs and small cranberry swales and outer dunes to the north sparsely covered in dune grass, wrinkled rose (*Rosa rugosa*) and poison ivy (*Rhus radicans*). The predominant vegetation is dune grass, bayberry (*Morella pensylvanica*), poison ivy and wrinkled rose.

Wyer's Point- Northeast side of Coatue. Predominated by eastern red cedar (*Juniperus virginiana*) and low growing shrubs.

Open Heathland/grassland:

Mass. Audubon property- The predominant plant species are scrub oak (*Quercus ilicifolia*), black huckleberry (*Gaylussacia baccata*), low-bush blueberry (*Vaccinium angustifolium*), Pennsylvania sedge (*Carex pensylvanica*), and little bluestem grass (*Schizachyrium scoparium*). The plot is in an area with moderate elevation variation and contains large huckleberry clones, open grassy areas, and clumps of scrub oak, each no more than three meters high.

Ram Pasture- Similar to Mass. Audubon property in vegetation though with more grasses and herbaceous species. The site is relatively flat and located a few hundred meters from the southern coast.

Sanford Farm- A relatively high elevation site, in an opening surrounded by scrub oak (*Quercus ilicifolia*), predominated by Pennsylvania sedge (*Carex pensylvanica*), little bluestem grass (*Schizachyrium scoparium*), and dewberry (*Rubus hispidus*). There are a few, widely spaced, large black cherry trees (*Prunus serotina*).

Dense Heathland/grassland:

Madequecham- Scrub oak and pitch pine on the east side of the island. The predominant plant species are scrub oak (*Quercus ilicifolia*), pitch pine (*Pinus rigida*), black huckleberry (*Gaylussacia baccata*), vibrunum (*Vibrunum dentatum*), bayberry (*Morella pensylvanica*), and low-bush blueberry (*Vaccinium angustifolium*). It is has a very dense shrub layer interrupted by a few small blueberry swales and grassy areas and a dirt road passes through the plot.

Pout Ponds Area- Scrub oak and pitch pine in the central portion of the island. Vegetation is similar to Madequecham.

Sheep Pond- Scrub oak and pitch pine on the west side of the island. The predominant plant species are pitch pine (*Pinus rigida*), scrub oak (*Quercus ilicifolia*) and black huckleberry (*Gaylussacia baccata*). The oak is denser here than at the Madequecham plot and the huckleberry clones are also smaller. There are several large ant mounds of the family Formicinae in the scrub oak areas.

Tupelo Forest:

Squam Swamp- The predominant plant species are 12-20 meter high tupelo trees (*Nyssa sylvatica*), red maple (*Acer rubrum*), sweetpepper bush (*Clethra alnifolia*), cinnamon fern (*osmunda cinnamomea*), goldenrod (S*oldago sp.*), and poison ivy (*Rhus radicans*).

Fig. 1. Collection sites for harvestmen on Nantucket and Tuckernuck Islands.

Identification

We used Bishop (1949) and Pinta-da-Rocha *et al.* (2007) to identify specimens.

Results

We sorted 413 harvestmen specimens from samples comprising 1,315 trap nights. We identified five total species (Table 1). More harvestmen were captured per trap in open heathland and grassland sites compared to other habitats. *Hadrobunus maculosus* was the most abundant species and traps at Sanford Farm, an open heathland/grassland site, produced the highest percentage of *H. maculosus* specimens (38%). The fewest trap nights were recorded in dune habitat and these samples yielded the fewest number of specimens.

Table 1. Number of specimens and trap nights by habitat or collection method. Genera are *Hadrobunus*, *Leiobunum*, and *Phalangium*.

		----------Number of Specimens----------						
Habitat	Trap Nights	*H. maculosus*	*L. ventricosum*	*L. formosum*	*L. vittatum*	*P. opilio*	Undetermined	Harvestmen/ Trap
Tupelo Forest	412	43	12	37	0	0	0	0.45
Open Heathland/Grassland	397	206	18	11	0	0	3	0.60
Dense Heathland/Grassland	376	35	27	6	0	0	7	0.20
Dune	130	1	4	0	0	0	0	0.04
Hand collected	0	1*	0	0	3**	1	0	-
Total	1315	286	61	54	3	1[+]	10	-

*In dune habitat at Wyer's Point. **Tuckernuck, dense heathland/grassland. [+]Residential, in town of Nantucket

When testing for significance in species distributions, we excluded data from the dune sites because of low sample size. For each abundant species (except *L. vittatum* and *P. opilio*) we ran an ANOVA comparing abundance per trap night between tupelo forest, open heathland and dense heathland (Table 2). There was a significant difference only for *H. maculosus* (One-way ANOVA, $p < 0.001$, $dF = 2$ between habitats, 354 within habitats). Unpaired t-tests showed that *H. maculosus* was significantly more common in open heathland compared to dense heathland or tupelo forest ($p < 0.001$ and $p = 0.014$ respectively).

Table 2. P-values for One-way ANOVAs and unpaired t-tests comparing harvestmen abundance in three habitats.

	One-way ANOVA	Open Heathland	Dense Heathland
H. maculosus	$p < 0.001$		
Tupelo Forest		$p = 0.014$	$p = 0.309$
Open Heathland			$p < 0.001$
L. ventricosum	$p = 0.536$		
L. formosum	$p = 0.160$		

Discussion

We identified all four species that Emerton found 80 years ago, although *L. vittatum* was only collected on Tuckernuck Island. We assume that *L. vittatum* still exists on Nantucket and that we will find it through further searching. We added the additional non-native species *P. opilio*. This species, originally from Europe, is now widely distributed around the northern hemisphere.

Our most common species, *H. maculosus*, is understudied and little information is available on its habitat preferences. It has been observed in the field and in the lab scavenging earthworm carcasses (Halaj and Cady 2000). The other species are mostly scavengers but one, *P. opilio*, has been observed hunting live arthropods.

It is important to note that because this study is based mostly on pitfall trap data, the relative abundance results for the different habitats may be biased by the methodology. Hand collecting and litter sorting would increase the accuracy of relative abundance. This is probably an important factor in most harvestmen studies and a reason that, while there is a good body of work on harvestman habitat preference in North America, there are no conclusive results (see Pinto-da-Rocha et al. 2007). It is known that moisture, a difficult to control variable in field studies, is an important factor in distribution because some species are more prone to desiccation that others (Edgar 1971). Annual variation in harvestmen abundance complicates habitat preference studies. There is at least one long term study (10 years) that found that the abundance of common harvestman varied greatly between years, up to a twofold difference for one species (Owen 1991). This all suggests that the abundances and the species relationships to habitat are preliminary and need to be confirmed with a larger study.

Our work re-confirms the presence of harvestman species that Emerton found and adds one species to the list. It also provides a baseline dataset with an associated sampling effort for comparison with future studies. We will continue sorting harvestmen from previously collected samples and continue collecting new specimens. Specimens are currently stored at the Maria Mitchell Natural Science Museum, but half of the collection will be deposited with the Museum of Comparative Zoology in Cambridge, Massachusetts.

Literature Cited

Bishop, S.C. 1949. Phalangida (Opiliones) of New York. *Proceedings of the Rochester Academy of Science*. 9(3): 159-235.

Edgar, A.L. 1971. Studies on the biology and ecology of Michigan Phalangida (Opiliones). *Miscellaneous Publications, Museum of Zoology, University of Michigan.* 144:1-64.

Halaj, J. and A.B. Cady. 2000. Diet composition and significance of earthworms as food of harvestmen (Arachnida: Opiliones). *American Midland Naturalist*, 143:487-491.

Johnson, C.W. 1930. A list of the insect fauna of Nantucket, Massachusetts. *Publications of the Nantucket Maria Mitchell Association*., 3(2):175pp.

Motzkin, G., D. R. Foster, A. Allen, J. Harrod, and R. D. Boone. 1996. Controlling site to evaluate history: vegetation patterns of a New England sand plain. *Ecological Monographs* 66: 345-365.

Owen, D.F. 1991. Opiliones (Arachnida) at a single site: ten years of monitoring. *Entomologist's Monthly Magazine.* 127:107-108.

Pinto-de-Rocha, R., Machado, G., and G. Giribet. 1997. *Harvestmen: The Biology of Opiliones*. Harvard University Press, 597 pp.