

Distribution, and Species Richness of Odonates at Brookhaven National Laboratory

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Eastern Pondhawk
Dragonfly eating a
Sweating Spreadwing
Damselfly



Amber-winged Spreadwing
Damselfly

INTRODUCTION

Research conducted during the summer of 2004 was a continuation of the Qualitative Odonate identification and cataloging research conducted during the summer of 2003. The research for 2004 focused mainly on the adult population of odonates with an emphasis on the species richness (number of species) of the aquatic insects found at Brookhaven National Laboratory (BNL). The goal was to survey all the ponds at the Lab, catalog, and preserve one male and female of every species found supporting the Odonate Atlas Project that was started in 2002 by New York State Department of Environmental Conservation. Part of the research project was also to continue looking for the three species of damselflies on the New York State list of threatened and endangered species.

The Order Odonata arose and flourished about 250 to 300 million years ago during the Carboniferous period and during which time they were gigantic with wingspans that reached approximately 70 cm (27.5 inches). It is believed that atmospheric oxygen played a major role in the increase and decrease in size of these organisms.

Odonates are extremely beneficial aquatic insects both as adults and larvae. Once larvae have hatched they begin their aquatic life as a voracious predator of mosquito larva, fresh water invertebrates, small tadpoles and fish, as well as their own species. Odonates have an exoskeleton as do all other invertebrates and must molt periodically in order to grow. These molting phases are called instars and Odonates have approximately 10 to 20 of these phases. The final molting phase is referred to as emerging in which the larvae crawl out of the water, molts and sheds its exoskeleton. The exoskeleton is called an exuviae and the newly emerged adult is called the exuviant. Once its wings and body have expanded to their full length, this voracious predator begins its life of hunting on the wing (in flight) feeding on mosquito, gnats, aphids, moths, butterflies, and smaller odonates, in turn they are preyed upon by parasites, frogs, toads, spiders, and birds.

The two main suborders of Odonata, dragonflies and damselflies, look a lot alike except for some of their basic physical traits that make them distinguishable by site from one another.

Differences Between The Two Suborders	
Dragonflies	Damselflies
Strong fliers	Weak fliers
Eyes touch on top of the head	Eyes are well separated
Fore- & hindwings are of different shape	Fore- & hindwings are similar in shape
At rest, they hold wings away from body at an angle of 180°	At rest, the wings are held close to the body



Common Green Darner
Dragonfly



Eastern Forktail
Damselfly

MATERIALS AND METHODS

Fieldwork was conducted with the aid of a variety of tools and materials, including two 15" insect nets one mesh and the other canvas with mesh bottom, dip net, chest waders, field vest, zip-lock sandwich bags, a digital camera, and a cooler containing ice. The chest waders were worn while wading in or around the ponds where odonates could be found. The insect nets were used to catch adult specimens while they were in flight or perched on vegetation. Once specimens were caught they were placed in the zip-lock bags and placed in the cooler to slow down their metabolism, keeping them alive and maintaining their vibrant coloration. The digital camera was used to take pictures of odonates in their natural settings. An aquarium was used to rear larvae in order to key to species.

A 7x Bausch & Lomb dissecting microscope, dissecting tweezers, metric ruler, specimen trays, petri dishes, gel filled petri dishes, and mounting pins were the tools used to examine the specimens. The dissecting microscope was used to magnify features specified in the taxonomic keys and field guides. Once larval specimens were identified large larvae were placed in an aquarium and reared until they emerged. One male and one female from each species were preserved by first euthanizing them in kill jars using acetone vapors. They were then placed in transparent specimen envelopes, labeled with the individual's data, then placed in a jar with enough acetone to cover the envelope and allowed to sit over night to reduce any fats within the specimens. The next day they were removed and dried for an hour or so and stored in a file box.



Cherry-Faced Meadowhawk
Dragonfly



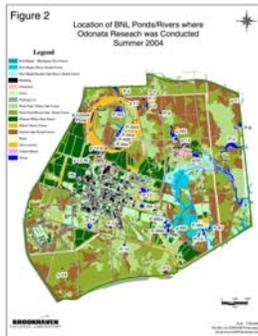
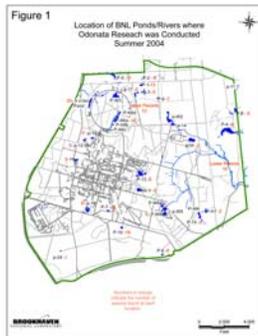
Common Green Darner (*Anax junius*)
Dragonfly larva



Azure Bluet
Damselfly



Adult Twelve-spotted Skimmer (*Libellula pulchella*)
newly emerged



RESULTS

During the summer of 2004, twenty-eight ponds and the Peconic River were surveyed or resurveyed at the Lab, including the nine surveyed during the summer of 2003 (P-1, P-2, P-6, P-7, P-9, P-10, 9 O'clock pond at the RHIC Ring, as well as the Recharge Basins 6a, 6b, 6c, and 6d at the RHIC Ring, and the Peconic River). Due to low precipitation during the ten weeks of the summer internship of 2004, a total of 4.44 inches (precipitation total) during the months of June and July, several of the vernal ponds had dried up before they were surveyed. A total of fifteen new species were found at the Lab, nine new damselflies, and six new dragonflies. To date a total of forty-six species have been found at Brookhaven National Laboratory. Table 1 shows the distribution for each species and Figure 1 shows the species richness of each location surveyed at BNL. Pond 7 for the second year in a row was found to have the highest species richness with a total number of 24 species followed by Pond 10 with 19 species, 9 O'clock Pond with 18, Lower Peconic River with 16, and Upper Peconic River with 15. Three ponds, P-W6b, p-12-E, and vp-10 were found to have 0 species possibly due to the fact they had dried up. Coincidentally the first three ponds with the highest species richness were also found to have high pH ranging between 8.0-9.0. This coincidence warrants further investigation.

Table 1
Species Distribution Table

Species	Scientific Name	Distribution
Dragonflies		
Family Anisoptera		
Common Green Darner	<i>Anax junius</i>	3
Shallow Darter	<i>Aeshna umbrosa</i>	2
Searing Darter	<i>Erythemis simplicicollis</i>	4
Family Corduliidae		
Whitman's Emerald	<i>Somatochlora williamsi</i>	1
Family Gomphidae		
Mayfly Skimmer	<i>Gomphus viridis</i>	1
Upright Libellid	<i>Libellula vittipennis</i>	2
Family Libellulidae		
Large-spined Meadowhawk	<i>Symphetrum semitorquatum</i>	4
Black Spotted Skimmer	<i>Libellula axonota</i>	1
Black Spotted Skimmer	<i>Tramea borealis</i>	4
Blue Dasher	<i>Libellula depressa</i>	2
Blue Dasher	<i>Pachydiplax longipennis</i>	17
Damselflies		
Carolina Darter	<i>Tramea carolina</i>	11
Cherry-Faced Meadowhawk	<i>Symphetrum internum</i>	11
Common Whirligig	<i>Libellula venusta</i>	15
Eastern Amberwing	<i>Pseudischnops terra</i>	2
Eastern Pondhawk	<i>Erythemis simplicicollis</i>	6
Great Blue Skimmer	<i>Libellula ulbrichti</i>	6
Large-spined Skimmer	<i>Libellula axonota</i>	1
Parula Skimmer	<i>Libellula pumila</i>	1
Searing	<i>Dryobates</i>	7
Mayfly Skimmer	<i>Libellula vittipennis</i>	2
Spine-winged Girdler	<i>Parasida zimmermani</i>	1
Parula Spotted Skimmer	<i>Libellula axonota</i>	15
Wandering Glider	<i>Parasida flavescens</i>	1
White-faced Meadowhawk	<i>Symphetrum obtusum</i>	4
Whisker Skimmer	<i>Libellula julia</i>	2
Damselflies		
Family Calopterygidae		
Ebony Jewelwing	<i>Calopteryx maculata</i>	1
Family Coenagrionidae		
Blue Bluet	<i>Enallagma aspersum</i>	11
Big Bluet	<i>Enallagma damum</i>	1
Eastern Forktail	<i>Ischnura elegans</i>	6
Eastern Forktail	<i>Ischnura verticalis</i>	8
Fragile Forktail	<i>Ischnura pumila</i>	3
Mayfly Bluet	<i>Enallagma damum</i>	1
Northern Bluet	<i>Enallagma cyathigerum</i>	1
Rainbow Forktail	<i>Ischnura ramburi</i>	3
Variable Bluet	<i>Enallagma geminatum</i>	1
Variable Bluet	<i>Alga fulvipes</i>	1
Family Libellidae		
Amber-winged Spreadwing	<i>Leisleria eximia</i>	3
Common Spreadwing	<i>Leisleria dimorpha</i>	1
Slender Spreadwing	<i>Leisleria melanoptera</i>	5
Slender Spreadwing	<i>Leisleria melanoptera</i>	5
Lyre-tipped Spreadwing	<i>Leisleria uropulchra</i>	5
Indicates the species found in 2004		



Blue Dasher
Dragonfly



Fragile Forktail
Damselfly

DISCUSSION AND CONCLUSION

A total of 28 ponds and the Peconic River were surveyed at Brookhaven National Laboratory in Upton, New York (Figure 1 shows the location of all the ponds surveyed and Figure 2 shows the vegetation found at BNL). To date a total of 46 odonate species have been found to inhabit various wetlands at the Laboratory. Thirty-one species of odonates were found during the summer of 2003 and another 15 species of odonate were found during the summer of 2004, 9 damselflies and 6 dragonflies, none were the threatened species of *Enallagma*. It appears that several of the ponds that were found to have high species richness are found in areas of Pitch Pine-White Oak, Mixed Oak, Successional, or Scarlet Oak Forests. The shaded cells in Table 1 indicate, which of the species were found in 2004. A continuing trend from summer 2003 research was the high species richness found at P-7 and the 9 O'clock pond as well as P-10. All three of these ponds are found in open areas. Another coincidence was that all three were found to have a pH between 8.0-9.0. Although odonates can tolerate a fairly wide range of pH, this coincidence could be related to vegetation, and fish populations, in any case the coincidence warrants further investigation in the future. The Upper Peconic River and the Lower Peconic River were found to have more than a dozen species. No samples were obtained from, P-W6b, p-12-E, and one other vernal pool. This could be due to the fact that they do not retain water long enough to sustain nymphs that remain in nymphal form for 1-3 years.

Distribution of the different species varied as they did with the 2003 research. The Common Green Darner (*Anax junius*) was found at seventeen locations. While several other species of dragonflies have only been found at one location.

At times it was difficult to catch some of the larger specimens for cataloging especially the quick aerial dragonflies such as the Common Green Darner (*Anax junius*). The best method used to obtain the larger specimens was to rear the larvae in an aquarium until they emerged as an adult. While in the field several macro pictures of a single specimen, were taken and logged then upon returning to the office, downloaded. The photos were then used to identify the specimen using field guides. In many instances the specimens were also caught and analyzed under the dissection microscope.

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Slaty Skimmer
Dragonfly



Halloween Pennant
Dragonfly