Identification and Distribution of Various Species of Adult Odonata at Brookhaven National Laboratory

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ABSTRACT

Identification and Distribution of Various Species of Adult Odonata at Brookhaven National Laboratory. MEGAN C. DYER (University of Rhode Island, Kingston, RI, 02881) DR. TIMOTHY M. GREEN (Brookhaven National Laboratory, Upton, NY 11973).

There are about 5,500 odonate species (dragonflies and damselflies) in the world, 164 of which can be found in the New York area. The purpose of this project was to identify and catalog the various species of dragonflies and damselflies inhabiting the wetland habitats of Brookhaven National Laboratory in Upton, New York. Specimens were collected in the field using a 15" white mesh insect net, a digital camera, chest waders, zip-lock bags, and a cooler full of ice. Specimens were identified in the lab using taxonomic keys, 20x field microscope, dissecting forceps, a refrigerator, and the Internet. There were a total of 25 species of odonates found to inhabit the ponds of the Lab, 18 dragonfly species and 7 species of damselfly. The data collected will be put together with other continuing research that is cataloging all species of flora and fauna found at Brookhaven National Laboratory.

INTRODUCTION

For millions of years, even before the evolution of dinosaurs, odonates had flown the skies [1]. Once having a wingspan measuring 70 cm (27.5 in.), they prey on any insect smaller than themselves, even of their own species. The word odonate comes from the phylogenic order Odonata and is split into three families: Anisoptera (dragonflies), Zygoptera (damselflies), and Anisozygoptera, which groups two rare species found exclusively in Nepal and Japan [2]. Qualitative research was conducted this summer on the first two families, Anisoptera (dragonflies) and Zygoptera (damselflies), at Brookhaven National Laboratory in Upton, New York. The research focused on cataloging the adult species found around some of the Lab's ponds (P-1, P-2, P-6, P-7, P-9, P-10, and RHIC (Relativistic Heavy Ion Collider) 9 o'clock Pond) and was coordinated with another intern's research on the larval population.

Like all other invertebrates, odonates have an exoskeleton that must be molted in order to grow. These skeletons are called exuviae and the emerging insect is the exuviant. Each stage at which they shed is called an instar, and the average odonate goes through approximately 10 to 20 of these stages before emerging as an adult, which takes anywhere from 3 months to 10 years, depending upon the species [2]. During these instars, the odonate larvae live underwater, preying upon such things as mosquito larva, fresh water invertebrates, and even small tadpoles and fish [2], falling prey themselves to larger fish, frogs, tadpoles, and parasites. Upon emergence, their diets consist of mosquitoes, gnats, aphids, moths, butterflies, and smaller odonates, but again, are fed upon by parasites, frogs, toads, spiders, and birds [3]. Most odonates are long lived and have been known to over winter as adults on the inside of trees near their larval habitat, while others partake in long migration flights, including transoceanic journeys [2].

Odonates play an important role in ecosystems, often being utilized as indicator species. Since their lives depend upon the water for food and reproduction, any shift in water quality can greatly disturb their populations. Each species having a different threshold of tolerance to pollution, a pond with a very diverse population of odonates is a good sign of a healthy environment, while one with a limited population is often a sign of problems in the local ecosystem [4].

Although dragonflies and damselflies look a lot alike, there are many basic physical traits that make them differ. Dragonflies have round heads with 2 compound eyes that touch in the middle of their face, above the mouth. The heads of damselflies are oval-shaped with tapered ends, their compound eyes located at both ends, and their mouth in the middle. Also, the hind-wing of a dragonfly is broader than the forewing and are kept straight out to the sides while at rest [5]. Damselflies on the other hand, have fore- and hind-wings that are similar in size, shape, and venation [2] and they fold them over their backs when not in flight [5]. Still another differing characteristic is the abdomen. Damselflies have a long, sleek, delicate looking abdomen, while dragonflies have a thicker one, sometimes with swollen segments or spikes that classify them into such groups as Clubtails, or Spiketails.

There are currently three species of damselfly, the Pine Barrens Bluet (Enallagma recurvatum), Scarlet Bluet (E. pictum), and the Little Bluet (E. minisculum), which are listed as threatened on the New York State list of endangered species [6]. Part of the project was to see if any of these species were present at the Lab, and where they were located. Research was conducted as part of a Lab-wide project that is cataloguing all species found at the Lab and putting them under the Natural Resources page of the Brookhaven National Laboratory web site.

MATERIALS AND METHODS

Field work was accomplished using a variety of materials, including a white 15” mesh butterfly net, insulated chest waders, zip-lock sandwich bags, a digital camera, and a cooler full of ice. The chest waders were worn out into the water and the net was used to catch the Odonates as they flew past. Once caught, they were carefully removed from the net, put into zip-lock bags and placed in the cooler. The cooler of ice was used in order to bring down the body temperature of the dragonflies and damselflies, making it easier to observe them under the microscopes back at the lab. The digital camera was used to take pictures of the odonates while in the field, in their natural environment.

A 20x field microscope, dissecting forceps, a refrigerator, the Internet, and taxonomic keys to the odonates were used in order to identify specimens collected from the field. The microscope and forceps were used in order to identify specimens based on minute characteristics that can’t be seen by the naked eye, such as wing venation, presence or absence of hairs, and body coloration. The refrigerator was used in order to keep the specimens’ body temperatures low enough where they weren’t able to move quickly under the microscope. The Internet and the Odonate keys were used to identify collected specimens to genus and species, based on their basic morphological traits and coloration patterns. Species of dragonflies were also identified from pictures taken in the field, as well as from pictures from the previous three years (2000, 2001, and 2002) that had been taken by Dr. Timothy Green.

RESULTS

During Summer 2003, eight areas (P-1, P-2, P-6, P-7, P-9, P-10, 9 o'clock pond, and the Peconic River) were surveyed for adult dragonfly and damselfly populations at Brookhaven National Laboratory in Upton, New York. A total of 25 species of odonates, 18 dragonflies and 7 damselflies, were found to inhabit these ponds (see Table 1 for a complete listing of species found and the places they were found at).

Figure 1 is a map of Brookhaven National Laboratory and shows locations of the eight different areas that were surveyed for adult odonates. Species richness varied among the eight locations surveyed. Pond 7 was found to be the most species rich with a total of 15 odonate species, 11 dragonflies and 4 damselflies (Figure 2). Pond 2 was found to have the least amount of species with 1 dragonfly and 1 damselfly found (see Table 2 and Figure 3).

DISCUSSION AND CONCLUSIONS

This research project was conducted during the summer of 2003, the purpose of which was to catch and identify as many species of Odonates as possible, given the limited time span. A total of 25 odonate species were found to inhabit the wetlands of Brookhaven National Laboratory in Upton, New York (Tables 1 and 2), none of them being of the 3 threatened *Enallagma* species mentioned before. All of these species were found to be common in the New York area.

One of the trends noticed was that there was a higher species richness at P-7 and 9 o'clock pond (at the RHIC Ring (Table 2)), both of which are surrounded by open area, versus a noticeably smaller species richness at the ponds enclosed by trees, like P-2 and P-6 (Figures 2

and 3). This openness may make it optimal habitat because it is easier for the dragonflies and damselflies to hunt for prey.

There was also a variation found in the distribution of the different species. The Twelve-Spotted Skimmer (*Libellula pulchella*), for example, was found to inhabit six of the locations surveyed, while some of the species, like the Unicorn Clubtail (*Arigomphus villosipes*), were only found at one location. This distributional variation may in part be due to the environmental requirements of the species. For instance, some species are very particular about the type of habitat they live in. The Unicorn Clubtail, a species of dragonfly, requires ponds with little to no submerged vegetation, so they were only found at the Lab's recharge basins, while the Twelve-Spotted Skimmer requires eutrophic, shallow, or semi permanent ponds, lakes, and slow streams [7], which most of the areas surveyed fit the description of.

In damselflies, the Slender Spreadwing (*Lestes rectangularis*) was found at five locations, while the Ebony Jewelwing (*Calopteryx maculata*), was only found at one. This is because the Ebony Jewelwing requires slow moving water, and the Peconic River is the only place on the Lab's property that fulfills that requirement, while the Slender Spreadwing requires partly shaded ponds, swamps, marshes, and slow streams, which describes almost all of the wetlands around the Lab.

There were a few complications that came up during the research. While in the field, it was difficult to take pictures of some of the species, because as they were approached, they would sometimes fly away. This really became a problem at P-10 because as the odonates flew away, they were many times caught by the resident tree swallows which would bring them back to the nest boxes to feed their young. It was also difficult to see if the pictures taken with the camera were clearly focused until the pictures had been downloaded back at the office. The only

problem that arose at the office was in the identification process. Some of the species of damselfly were difficult to identify using the taxonomy keys [20 and 21] because they didn't meet all of the criteria for the species. Going with the step that held true with the most characteristics solved this, but leaves the final identification unverified.

Further odonate research is being considered for future internships that would catalog the rest of the ponds found at the Lab. The current research, as well as any future research, may be used in a New York State Odonata Atlas, which would be available to the public. The data collected above is in the process of being made available as a web page on the Brookhaven National Laboratory web site. This web site is open to the public and contains a listing of flora and fauna found at the Lab. It can be viewed at: http://www.bnl.gov/esd/wildlife/Invertebrates.htm.

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TABLE 1. Compilation of odonate species identified and survey locations where found.

Family	Scientific Name	Common Name	Locations found
Suborder Anisoptera			
Aeshnidae	Aeshna umbrosa	Shadow Darner	Peconic River
	Anax junius	Common Green Darner	P-1, P-6, P-7, P-9, P-10, 9 O'Clock Pond
	Anax longipes	Comet Darner	P-1, P-7
	Epiaeschna heros	Swamp Darner	
Corduliidae	Erythemis simplicicollis	Eastern Pondhawk	9 O'Clock Pond
Gomphidae	Arigomphus villosipes	Unicorn Clubtail	
Libellulidae	Libellula deplanta	Blue Corporal	
	Libellula incesta	Slaty Skimmer	Peconic River
	Libellula luctuosa	Widow Skimmer	P-7
	Libellula lydia	Common Whitetail	P-7, P-10, 9 O'Clock Pond, Peconic River
	Libellula pulchella	Twelve-Spotted Skimmer	P-1, P-6, P-7, P-9, 9 O'Clock Pond, Peconic River
	Pachydiplax longipennis	Blue Dasher	P-1, P-2, P-6, P-7, P-9
	Pantala flavescens	Wandering Glider	P-10, 9 O'Clock Pond
	Perithemis tenera	Eastern Amberwing	P-7, 9 O'Clock Pond
	Sympetrum internum	Cherry-Faced Meadowhawk	P-1, P-7, Peconic River
	Sympetrum obtrusum	White-faced Meadowhawk	P-1, P-7
	Tramea carolina	Carolina Saddlebags	P-6, P-7, 9 O'Clock Pond
	Tramea lacerata	Black Saddlebags	P-1, P-7, 9 O'Clock Pond, Peconic River
Suborder Zygoptera			
Calopterygidae	Calopteryx maculata	Ebony Jewelwing	Peconic River
Coenagrionidae	Argia fumipennis violacea	Variable Dancer	P-10
	Enallagma cyathigerum	Northern Bluet	P-1, P-9
	Ischnura ramburii	Rambur's Forktail	P-1, P-7, 9 O'Clock Pond
	Ischnura verticalis	Eastern Forktail	P-7, P-10
Lestidae	Lestes rectangularis	Slender Spreadwing	P-1, P-2, P-6, P-7, P-9
	Lestes unguiculatus	Lyre-tipped Spreadwing	P-6, P-7, P-10

TABLE 2. Distribution of the various odonate species across wetlands surveyed.

Species List	Locations Found								
Dragonflies	**P-1**	**P-2**	**P-6**	**P-7**	**P-9**	**P-10**	**9 O'Clock Pond**	**Peconic River**	**Misc.**
Blue Corporal									Z-Path
Blue Dasher									
Black Saddlebags									
Carolina Saddlebags									
Cherry-Faced Meadowhawk									
Comet Darner									
Common Green Darner									
Common Whitetail									
Eastern Amberwing									
Eastern Pondhawk									
Shadow Darner									
Swamp Darner									
Twelve-Spotted Skimmer									
Unicorn Clubtail									RHIC Basin
Wandering Glider									
White-faced Meadowhawk									
Widow Skimmer									
Damselflies									
Eastern Forktail									
Ebony Jewelwing									
Lyre-tipped Spreadwing									
Northern Bluet									
Rambur's Forktail									
Slender Spreadwing									
Variable Dancer									

Indicates presence of species in the given area

FIGURE 1.

Map of Brookhaven National Laboratory showing surveyed locations.

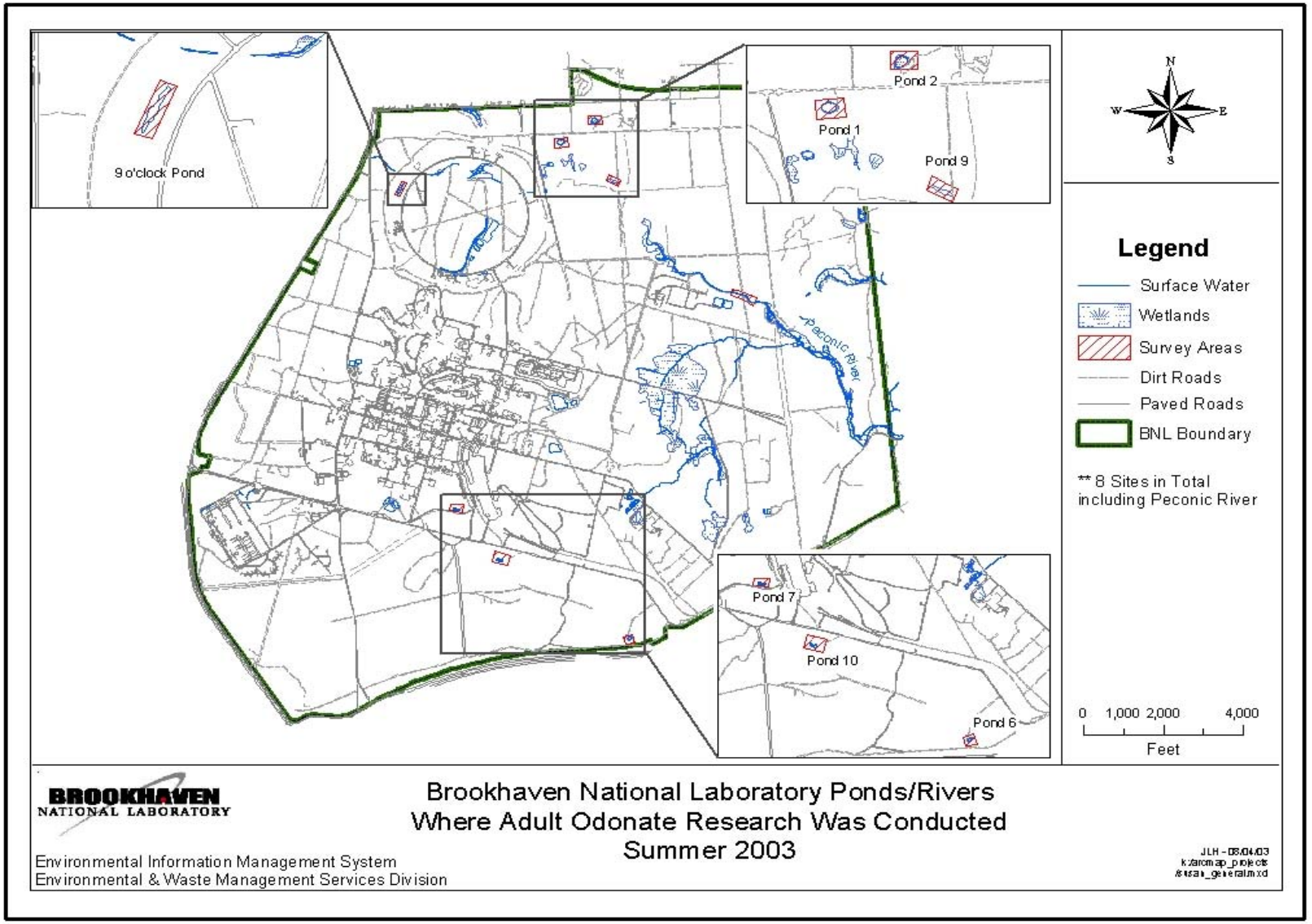

FIGURE 2. Map of Pond 7 with table of species found.

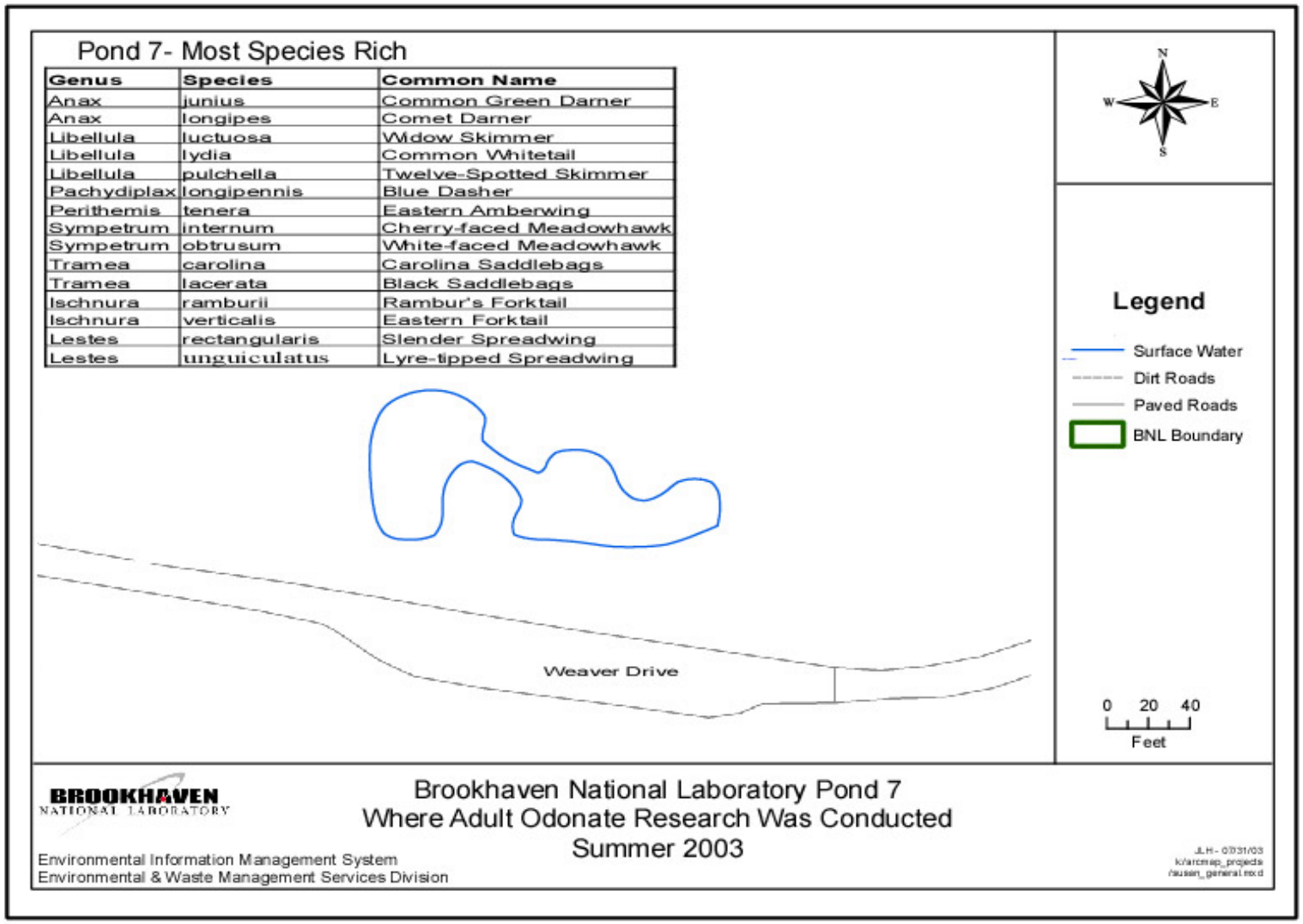

FIGURE 3. Map of Pond 2 with table of species found.