

**Odonate Species Survey in Correlation with Air Temperature and
Precipitation at Brookhaven National Laboratory**

Saneddy Quezada
CCI Program
Hostos Community College
Brookhaven National Laboratory
Upton, New York

August 1, 2005

Prepared in partial fulfillment of the requirements of the Office of Science, DOE
Community College Institute of Science and Technology (CCI) Program under the
direction of Dr. Timothy M. Green in the Environmental and Waste Management Services
Division (EWMS) at Brookhaven National Laboratory.

Participant: _____
Signature

Research Advisor: _____
Signature

Table of Contents

Abstract	3
Introduction	4
Materials and Methods	5
Results	5
Discussion and Conclusions	6
Acknowledgements	7
References	8
Tables	9
Graphs	12

Abstract

Odonate Species Survey in Correlation with Air Temperature and Precipitation at Brookhaven National Laboratory. SANEDDY QUEZADA (Hostos Community College, Bronx, NY 10451) DR. TIMOTHY M. GREEN (Brookhaven National Laboratory, Upton, NY 11973)

Odonate emergence data and summer weather conditions were the subject of research at Brookhaven National Laboratory for the summer of 2005. The project attempted to compare meteorological data from the summers of 2003, 2004, and 2005 and its correlation with the distribution and richness of Odonates at Brookhaven National Laboratory. The purpose of the project is to obtain accurate data that will assist in the understanding of Odonate emergence and behavior in correspondence with humidity, precipitation, and air temperature. The project utilizes weather records of the last two summers, courtesy of the National Weather Service located at Brookhaven National Laboratory. Data from the past two summers from the Environmental & Waste Management Services Division at BNL are also being applied to fulfill the goal of this project, as well as current sampling and assessment of the many wetlands on the BNL site. While sampling the ponds, a new species was added to the New York State list of Odonates *Celithemis verna* or Double-Ring Pennant. Also, one of the three threatened damselflies (*Enallagma recurvatum*) was recorded for the first time at BNL this summer. Further research is required for complete and accurate conclusions. Future work for this project will focus on the investigation and search for the two other threatened damselflies *Enallagma minusculum* and *Enallagma pictum*.

Introduction

Odonates are large predacious winged insects, which include *Anistopera* (dragonflies) and *Zygoptera* (damselflies). Odonates are physically characterized by long, bright colored bodies, two pairs of membranous wings, and large compound eyes. Earliest fossil records of Odonates indicate their existence approximately 300 to 325 million years ago. According to fossil records, their wingspan reached 70 to 75 centimeters long, making them one of the largest and oldest invertebrate groups ever to exist. Meteorological conditions may be a factor in the distribution of these insects. The project attempted to compare meteorological data from the summers of 2003, 2004, and 2005 and its correlation with the distribution and richness of Odonates at Brookhaven National Laboratory. The purpose of the project is to obtain accurate data that will assist in the understanding of Odonate emergence and behavior in correspondence with humidity, precipitation, and air temperature. The project utilizes weather records of the last two summers, courtesy of the Atmospheric Science Division at Brookhaven National Laboratory. Data from the past two summers of the Environmental & Waste Management Services Division at BNL are also being applied to fulfill the goal of this project, as well as current sampling and assessment of the many wetlands on the BNL site. While sampling the ponds, a new species was added to the New York State list of Odonates *Celithemis verna* or Double-Ring Pennant. Also, one of the three threatened damselflies (*Enallagma recurvatum*) was recorded for the first time at BNL this summer.

Materials and Methods

In order to collect adult Odonates a 15” net was used to catch insects while they were in flight or perched on vegetation. Chest waders were worn while wading in or around the ponds where odonates could be found. A pair of 10 x 50 Burris signature series binoculars was used to observe odonate behavior. Once the specimens were caught they were placed in glassine envelopes and then placed in a Tupperware container where they were kept alive to preserve their vibrant coloration. A digital camera was used to take pictures of the insects in their natural scenery.

Lab work was conducted with the aid of a variety of tools and materials, including a 7-25x Bausch & Lomb dissecting microscope to magnify the sections and features of the insect, dissecting tweezers and a gel filled Petri dish, to examine the sample. The insect was examined by first cooling it to slow down its metabolism and prevent color fading. Once the specimen was identified and its information recorded the insect was immediately immersed in acetone for 24 hours to dehydrate and to dissolve its body fat. After the 24-hour process they were removed from the acetone, dried for an hour and stored in a file box. Air temperature, humidity, and precipitation were recorded daily and analyzed with odonate emergence. An attempt to correlate data from the summers 2003, 2004 and 2005 was made.

Results

During the summer of 2005, a total of 12 wetlands were assessed on site at BNL. The Ponds surveyed were P-1, P-2, P-3, P-6, P-7, P-8, P-10, P-13, P-16, P-17, Zeke’s pond, and the Peconic River. Over the three years of Odonate research at BNL, 53 species have

been found out of 91 recorded in Suffolk County, including *Celithemis verna*, commonly known as the Double-ringed pennant, which was found for the first time at BNL this summer and is a new species record for inclusion on the New York State list of Odonates. After three years of search one of the three state threatened damselflies was found in Zeke's Pond *Enallagma recurvatum* commonly known as the Pine-barrens bluet. After analysis of the weather conditions and comparison with Odonate emergence, it was found that air temperature has no noticeable association with Odonate emergence. Precipitation on the other hand was found to have a visible correlation with Odonate emergence.

DISCUSSION

The purpose of the Odonate research of the summer of 2005 was to obtain accurate data that would assist in the understanding of the insects' emergence and behavior in correspondence with precipitation, and air temperature. Also, to continue with the identification and survey of the species found at Brookhaven National Laboratory, and to continue the search for the three endangered damselflies on the New York State list of threatened species.

A total of twelve wetlands were surveyed during the summer of 2005 (as shown in Table 3). To date a total of 53 Odonate species have been recorded at BNL, nine of those species were found during the summer of 2005, including one of the three threatened species of damselflies *Enallagma recurvatum*. The Double-ringed pennant (*Celithemis verna*) was found during the summer of 2005 at BNL and is a first time record for the New York State list of Odonates.

After analyzing the weather data obtained from the National Weather Service, located at BNL, it was found that between air temperature and Odonate emergence there is no visible correlation (as shown in Table 4), although there was a relationship between the number of Odonate individuals found when the air temperature rose above 80° F and the humidity reached 75%. In contrast, the precipitation charts in correspondence with emergence showed a noticeable association (as shown in table 2). Days after either a high or low point in precipitation, the level of Odonate emergence increased significantly. Showing that presenc/absence of precipitation affects the emergence and mating of these insects, although future research is needed to obtain precise answers for this connection.

ACKNOWLEDGEMENTS

I would like to take this opportunity to thank the U.S. Department of Energy, Office of Science for the opportunity to participate in the Community College Institute of Science and Technology. I also want to thank the CUNY Research Foundation and the Louis Strokes Alliances for Minority Participation (LSAMP) for sponsoring my internship. My mentor Tim Green, who provided excellent support and guidance throughout my whole intern experience and was always willing to take time to answer questions and offer guidance. Thanks also go to all the staff of the Environmental and Waste Management Services Division, and to Virginia Brown for her help and support.

I would also like to acknowledge all of the staff of the Department of Educational Programs of Brookhaven National Laboratory, above all to Noel Blackburn, Jen Clodius, Kathy Gurski, and Paul Guzzardo. Thanks go to my fellow interns Katie Hieser, Sonya Lamb, Cassandra Gill and to Dr. Rita Hagevik for their interest and help in my project and for allowing me to help with some of their research. Last but not least, I would like to thank

the Dean of Academic Affairs at Hostos Community College and my academic advisor Gerald Cohen, for guiding me in my college career and for making me realize the importance of conducting hands on research. I wouldn't have the privilege to be part of one of the premier research organizations in the world if it weren't for him.

REFERENCES

- New York State Department of Environmental Conservation: List of Endangered, Threatened, and Special Concern Fish & Wildlife Species of New York State. (2003 March. From: <http://www.dec.state.ny.us/website/dfwmr/wildlife/endspec/etsclist.html>)
- J.G. Needham, M.J. Westfall, Jr., M.L. May, "Dragonflies of North America", Gainesville: Scientific Publishers, 2000.
- M. J. Westfall, Jr., M. L. May, "Damselflies of North America", Gainesville: Scientific Publishers, 1996.
- S. W. Dunkle, "Dragonflies through Binoculars", New York: Oxford Press, 2000.
- E. Lam, "Damselflies of The Northeast", Published by Biodiversity Books, 2004.
- B. Nikula, J. L. Loose, M. R. Burne, " A Field Guide to the Dragonflies and Damselflies of Massachusetts", Publication of Natural Heritage & Endangered Species Program, 2003.
- National Weather Service, Upton, New York

Table 1 Species Distribution Table

Dragonflies	
Family Aeshnidae	Scientific Name
Shadow Darner	<i>Aeshna umbrosa</i>
Comet Darner	<i>Anax lonipes</i>
Common Green Darner	<i>Anax junius</i>
Swamp Darner	<i>Epiaeschna heros</i>
Harlequin Darner	<i>Gomphaeschna furcillata</i>
Family Corduliidae	
Williamson's Emerald	<i>Somatochlora williamsoni</i>
Family Gomphidae	
Unicorn Clubtail	<i>Arigomphus villosipes</i>
Ashy Clubtail	<i>Gomphus lividus</i>
Family Libellulidae	
Calico Pennant	<i>Celithemis elisa</i>
Halloween Pennant	<i>Celithemis eponina</i>
Double Ringed Pennant	<i>Celithemis verna</i>
Setwing	<i>Dythemis</i>
Eastern Pondhawk	<i>Erythemis symplicicollis</i>
Bar-winged Skimmer	<i>Libellula axilena</i>
Spangled Skimmer	<i>Libellula cyanea</i>
Blue Corporal	<i>Libellula deplanta</i>
Slaty Skimmer	<i>Libellula incesta</i>
Widow Skimmer	<i>Libellula luctuosa</i>
Common Whitetail	<i>Libellula lydia</i>
Twelve-Spotted Skimmer	<i>Libellula pulchella</i>
Painted Skimmer	<i>Libellula semifasciata</i>
Great Blue Skimmer	<i>Libellula vibrans</i>
Blue Dasher	<i>Pachydiplax longipennis</i>
Wandering Glider	<i>Pantala flavescens</i>
Spot-winged Glider	<i>Pantala hymenaea</i>
Eastern Amberwing	<i>Perithemis tenera</i>
Cherry-Faced Meadowhawk	<i>Sympetrum internum</i>
White-faced Meadowhawk	<i>Sympetrum obtrusum</i>
Ruby Meadowhawk	<i>Sympetrum Rubicundulum</i>
Band-winged Meadowhawk	<i>Sympetrum semicinctum</i>
Carolina Saddlebags	<i>Tramea carolina</i>
Black Saddlebags	<i>Tramea lacerata</i>
Damselflies	
Family Calopterygidae	
Ebony Jewelwing	<i>Calopteryx maculata</i>
Family Coenagrionidae	
Variable Dancer	<i>Argia fumipennis violacea</i>
Azure Bluet	<i>Enallagma aspersum</i>
Familiar Bluet	<i>Enallagma civile</i>
Northern Bluet	<i>Enallagma cyathigerum</i>
Atlantic Bluet	<i>Enallagma doubledayi</i>
Big Bluet	<i>Enallagma durum</i>
Marsh Bluet	<i>Enallagma ebrium</i>

Table 2

2005 Precipitation

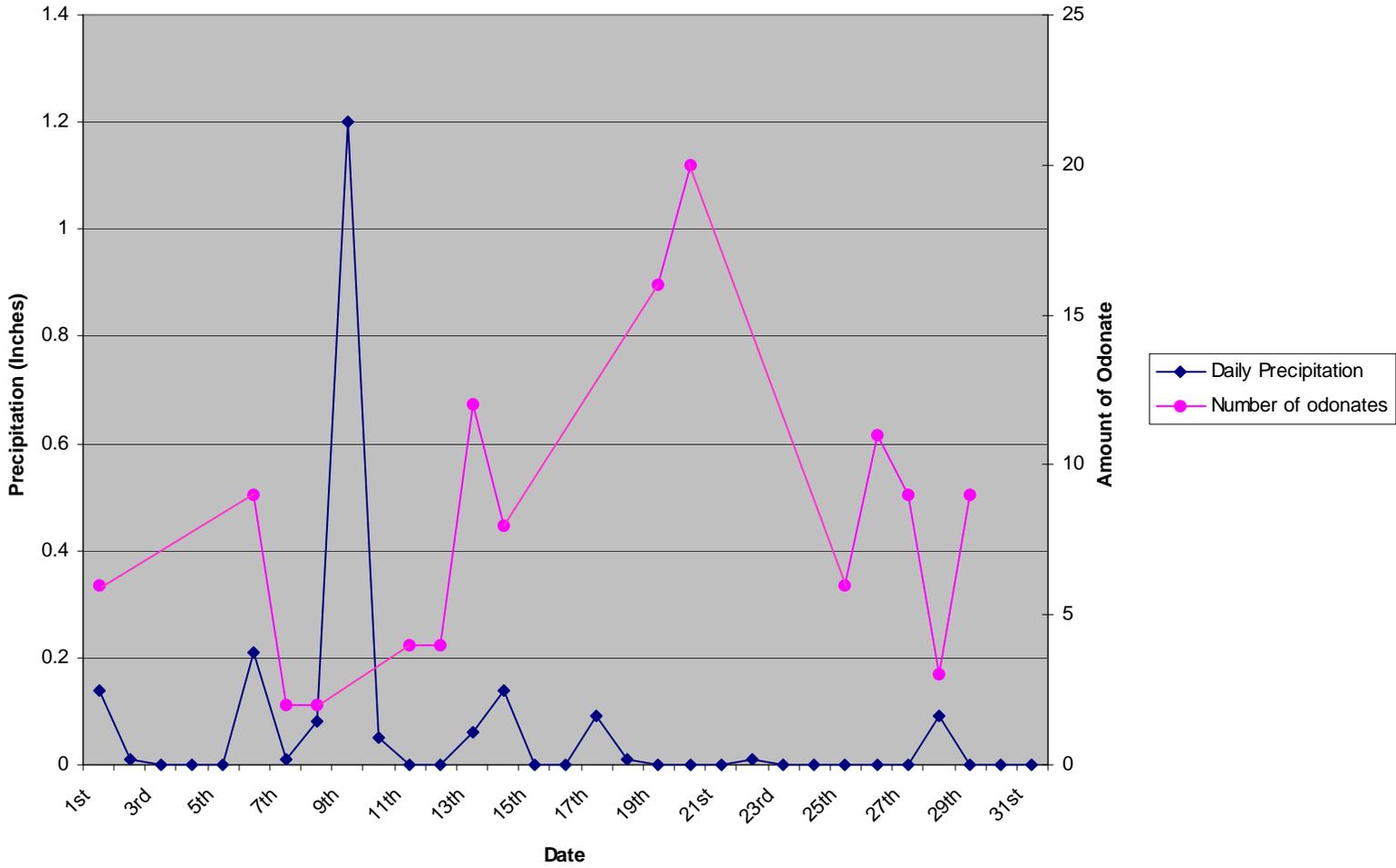


Table 3

BNL Ponds/Rivers where Odonata Research was Conducted



Table 4

Air Temperature 2005

