

**Additional Notes on the Dragonflies and Damselflies
of Jackson Lane Preserve based on the 2006 Field Season**



Painted Skimmer – Jackson Lane Large – 16-August-2006

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ABSTRACT: The dragonfly and damselfly populations of Jackson Lane Preserve (JL) continue to reflect the dynamic nature of the wetlands. Two major events at JL contributed to the observed differences between the 2006 and the 2004 data. These two events were the amount of seasonal water available to the wetlands in 2004 compared to 2006 and the succession of Cell #2 from a newly formed unstable mitigation pond in 2004 into a reasonably functional marsh in 2006. The shallow mitigation cells that were highly productive in 2004, produced few to no odonates in 2006 and the Delmarva Bays which were advantageous to temporary pond species in 2004, shifted to favor permanent water species in 2006. The major conclusions, along with the identified indicator species, provided in the 2004 report still appear sound. Three new odonate species, *Enallagma geminatum*, *Cordulegaster erronea*, and *Celithemis eponina* were added in 2006 to bring the total number of dragonflies and damselflies known from JL to sixty-one.

INTRODUCTION: The 2006 report from Jackson Lane Preserve (JL) builds upon the foundation report *The 2004 Survey of the Dragonflies and Damselflies of Jackson Lane Preserve* (Orr, 2004). Information and data provided in the 2004 report is not repeated. This report focuses on the data collected in 2006 and how it relates to confirming or modifying the biological conclusions reached in the 2004 report.

METHODS: Eight field days were spent at Jackson Lane in 2006 for the odonate study. Field trips took place on 31-March, 19-April, 03-May, 31-May, 11-July, 16-August, 17-September and 10-November in 2006.

Specific locations were targeted in 2006 for repeated visits. These included Jackson Lane Large (JLL), Jackson Lane Small (JLS), Pasture Pond, and Cell #2. In addition, all of the wetland cells, (including those from Phase 2) along with the ditches, East Broadway Branch and the smaller Delmarva Bays were visited at least once during the 2006 season.

The field survey was oriented towards adult and cast skin identification. All identified individual odonates encountered during the 2006 field work were recorded by date and location, along with any relevant observed behavior (e.g. oviposition, mating and territoriality).

The majority of identifications were by direct observation, or by netting and release. However, difficult or questionable identifications were taken to the lab for further examination. Voucher specimens were taken when the species was new to JL or encountered at an unexpected time of year. The voucher species have been labeled and prepared and will be deposited in the National Insect Collection located at the Smithsonian Natural History Museum.

RESULTS: In 2006, three species not seen in 2004 were added to JL (*Cordulegaster erronea*, *Celithemis eponina* and *Enallagma geminatum*). This brings the total number of dragonfly and damselfly species known from JL to sixty-one (Appendix 1).

Table 1 provides a species list of the dragonfly and damselfly species that were recorded during the 2006 field season along with the minimum number of adults seen on each of the field days.

TABLE 1: MINIMUM NUMBER OF ADULTS RECORDED

Scientific Name	31- Mar	19- Apr	03- May	31- May	11- Jul	16- Aug	17- Sep	10- Nov	SUM
<i>Calopteryx maculata</i>				4	4				8
<i>Lestes australis</i>			1			1			2
<i>Lestes congener</i>							50	8	58
<i>Lestes rectangularis</i>						1			1
<i>Enallagma aspersum</i>				6		42	1		49
<i>Enallagma civile</i>				20		31	8		59
<i>Enallagma geminatum</i>						3	1		4
<i>Enallagma signatum</i>				1					1
<i>Ischnura hastata</i>				2		35	1		38
<i>Ischnura posita</i>		6	19	50	8	100	14		197
<i>Ischnura ramburii</i>						2			2
<i>Ischnura verticalis</i>		1		4		30	9		44
<i>Gomphus exilis</i>		5							5
<i>Gomphus lividus</i>		15	3						18
<i>Anax junius</i>		4		15	30	40			89
<i>Basiaeschna janata</i>		1							1
<i>Epiaeschna heros</i>				8	4	7			19
<i>Gomphaeschna furcillata</i>		3							3
<i>Nasiaeschna pentacantha</i>					1	1			2
<i>Cordulegaster erronea</i>					3				3
<i>Cordulegaster maculata</i>		1							1
<i>Didymops transversa</i>		8							8
<i>Macromia illinoiensis</i>					1				1
<i>Epicordulia principis</i>				1	1				2
<i>Somatochlora linearis</i>					11	1			12
<i>Somatochlora tenebrosa</i>					1	2			3
<i>Tetragoneuria cynosura</i>		30	7	7					44
<i>Celithemis eponina</i>						30			30
<i>Celithemis elisa</i>					3	40			43
<i>Erythemis simplicicollis</i>				140	50	100	16		306
<i>Libellula axilena</i>					3	9			12
<i>Libellula cyanea</i>				70	8				78
<i>Libellula deplanata</i>		3	3	10					16
<i>Libellula incesta</i>				2	20	40	1		63
<i>Libellula luctuosa</i>					15				15
<i>Libellula lydia</i>		15	9	150	100	35	15		324
<i>Libellula pulchella</i>				30	3	20			53
<i>Libellula semifasciata</i>			6	19	9	2			36
<i>Libellula vibrans</i>					6	3	9		18
<i>Pachydiplax longipennis</i>				20	200	500			720
<i>Pantala hymenaea</i>					1				1
<i>Perithemis tenera</i>					3	60	2		65
<i>Sympetrum ambiguum</i>						1	20		21
<i>Sympetrum vicinum</i>							500	300	800
<i>Tamea carolina</i>				1	20	40	1		62
<i>Tamea lacerata</i>				1	10	40	2		53

Table 2 reflects the presence of probable larval development based on observations of cast skins, teneral adults or mature adult behavior (e.g. ovipositing, or territoriality). In 2006 no larval development occurred in the shallow water cells. Where the rows show all columns with a “no” then larval development occurred off site (e.g. river species).

TABLE 2: EVIDENCE OF LARVAL DEVELOPMENT BY LOCATION IN 2006:

Genus	Species	JL-Large	JL-Small	Pasture Pd	Cell #2	Ditches	Creek
<i>Calopteryx</i>	<i>maculata</i>	NO	NO	NO	NO	NO	YES
<i>Lestes</i>	<i>australis</i>	NO	NO	NO	YES	NO	NO
<i>Lestes</i>	<i>congener</i>	YES	YES	NO	NO	NO	NO
<i>Lestes</i>	<i>rectangularis</i>	YES	YES	YES	YES	YES	NO
<i>Enallagma</i>	<i>aspersum</i>	NO	NO	NO	YES	NO	NO
<i>Enallagma</i>	<i>civile</i>	YES	YES	YES	YES	YES	NO
<i>Enallagma</i>	<i>geminatum</i>	NO	NO	NO	YES	NO	NO
<i>Enallagma</i>	<i>signatum</i>	NO	NO	NO	YES	NO	NO
<i>Ischnura</i>	<i>hastata</i>	YES	YES	YES	YES	NO	NO
<i>Ischnura</i>	<i>posita</i>	YES	YES	YES	YES	YES	NO
<i>Ischnura</i>	<i>ramburii</i>	NO	NO	NO	YES	NO	NO
<i>Ischnura</i>	<i>verticalis</i>	YES	YES	YES	YES	NO	NO
<i>Gomphus</i>	<i>exilis</i>	YES	YES	YES	NO	NO	YES
<i>Gomphus</i>	<i>lividus</i>	NO	NO	NO	NO	NO	YES
<i>Anax</i>	<i>junius</i>	YES	YES	YES	YES	YES	NO
<i>Basiaeschna</i>	<i>janata</i>	NO	NO	NO	NO	NO	NO
<i>Epiaeschna</i>	<i>heros</i>	YES	YES	YES	NO	YES	NO
<i>Gomphaeschna</i>	<i>furcillata</i>	YES	YES	NO	NO	YES	NO
<i>Nasiaeschna</i>	<i>pentacantha</i>	YES	YES	YES	YES	YES	NO
<i>Cordulegaster</i>	<i>erronea</i>	NO	NO	NO	NO	NO	YES
<i>Cordulegaster</i>	<i>maculata</i>	NO	NO	NO	NO	NO	YES
<i>Didymops</i>	<i>transversa</i>	NO	NO	NO	NO	NO	YES
<i>Marcromia</i>	<i>illinoiensis</i>	NO	NO	NO	NO	NO	NO
<i>Epicordulia</i>	<i>princeps</i>	NO	NO	NO	NO	NO	NO
<i>Somatochlora</i>	<i>linearis</i>	NO	NO	NO	NO	NO	YES
<i>Somatochlora</i>	<i>tenebrosa</i>	NO	NO	NO	NO	YES	NO
<i>Tetragoneuria</i>	<i>cynosura</i>	YES	YES	YES	YES	YES	NO
<i>Celithemis</i>	<i>elisa</i>	NO	NO	NO	YES	NO	NO
<i>Celithemis</i>	<i>eponina</i>	NO	NO	NO	YES	NO	NO
<i>Erythemis</i>	<i>simplicicollis</i>	YES	YES	YES	YES	YES	NO
<i>Libellula</i>	<i>axilena</i>	YES	YES	YES	YES	YES	NO
<i>Libellula</i>	<i>cyanea</i>	YES	YES	YES	YES	NO	NO
<i>Libellula</i>	<i>deplanata</i>	NO	NO	NO	YES	NO	NO
<i>Libellula</i>	<i>incesta</i>	YES	YES	YES	YES	NO	NO
<i>Libellula</i>	<i>luctuosa</i>	NO	NO	YES	YES	NO	NO
<i>Libellula</i>	<i>lydia</i>	YES	YES	YES	YES	YES	NO
<i>Libellula</i>	<i>pulchella</i>	YES	YES	YES	YES	NO	NO
<i>Libellula</i>	<i>semifasciata</i>	YES	YES	YES	YES	YES	NO
<i>Libellula</i>	<i>vibrans</i>	YES	YES	YES	YES	YES	NO
<i>Pachydiplax</i>	<i>longipennis</i>	YES	YES	YES	YES	YES	NO
<i>Pantala</i>	<i>hymenaea</i>	YES	YES	YES	YES	NO	NO
<i>Perithemis</i>	<i>tenera</i>	NO	NO	NO	YES	NO	NO
<i>Sympetrum</i>	<i>ambiguum</i>	YES	YES	YES	NO	NO	NO
<i>Sympetrum</i>	<i>vicinum</i>	YES	YES	YES	YES	YES	NO
<i>Tramea</i>	<i>carolina</i>	YES	YES	YES	YES	NO	NO

<i>Tramea</i>	<i>lacerata</i>	YES	YES	YES	YES	NO	NO
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Significant changes in the odonate 2006 data when compared to 2004 data were:

- Reduction in the numbers of damselflies found at the mitigation cells.
- The establishment of a marsh indicator species (*Celithemis eponina*) into Cell #2.
- Late season dominance in 2006 for permanent water species in JLL and JLS compared to temporary water species which dominated in the fall of 2004.
- The finding of foraging adults of *Cordulegaster erronea* at JL.

DISCUSSION: The primary differences in odonate populations observed in 2004 and in 2006 can be attributed to two events. These two events were the amount of seasonal water available to the wetlands in 2004 compared to 2006 and the succession of cell #2 from a newly formed unstable mitigation pond in 2004 into the beginnings of a stable functional marsh in 2006.

The year before the 2004 survey, was one of the wettest years on record. Surface water was available throughout 2003 and well into the summer of 2004 providing nearly unlimited water for the newly formed mitigation ponds. However, by fall of 2004 the water level had dropped enough so that the Delmarva Bays and smaller mitigation cells had dried up.

In 2006 the situation was nearly the opposite. During the winter through early summer limited rains resulted in most of the mitigation cells remaining dry with only a few of the deeper cells and the Delmarva Bays retaining surface water (see appendix 3). Late season rains started in summer and lasted throughout the rest of the year. Surface water remained in the deeper cells and the Delmarva Bays throughout the whole year.

It is well documented that the effect of increased disturbance can provide a temporary opportunity for more species to coexist (Stachowicz and Tilman, 2005). During the 2004 season, the increased disturbance of the newly formed mitigation ponds/pools coupled with the extensive surface water during the 2003-2004 season provided the opportunity for a high number of odonate species to co-exist. By 2006 the mitigation cells had had more time to adjust to the JL environment. This possibly attributed to the marked decrease in the number of odonate species observed in 2006 from the cells. If this is the case, then it is possible that other aquatic taxa could show a similar trend.

During the spring of 2006 the most noticeable difference from the spring of 2004 was the decrease in the number of individual damselflies whose larval habitat is emergent vegetation within the cells. These huge reductions in the damselfly numbers were due to the drying out of the edges of the deeper cells and the complete drying of the shallow-

water cells in 2006 -- where emergent vegetation is normally abundant. *Ischnura posita*, *I. hastata*, and *Enallagma civile* are the most abundant species of damselflies in the mitigation cells. The average *Ischnura posita* seen per field day in the cells from April through May 2004 were 2,214 individuals while in 2006 it was less than one individual seen per visit. The average *Ischnura hastata* seen per field day in the cells from April through May 2004 were 19 individuals while in 2006 it was again less than one individual seen per visit. The average *Enallagma civile* seen per field day in the cells from April through May for 2004 was 179 individuals while in 2006 it was reduced to 7 individuals per visit. All three of these species started to increase in numbers by summer of 2006 due to the onset of late season precipitation -- but never really fully recovered from the lack of standing water during the early season months.

The numbers of odonates at the ditches and East Broadway Branch showed little change. Nor was there any noticeable change in the river species from Choptank River that utilize Jackson Lane for adult maturation and feeding. This is not unexpected since these are more stable aquatic habitats than the mitigation cells.

The Delmarva Bays also showed little change in diversity of their odonates but a change in numbers of individuals within their established species was noticed. There was a late season preference for temporary pond species in 2004 compared to the permanent pond species observed in 2006. Considering that these ponds were completely dry during the fall of 2004, but retained surface water throughout the year in 2005 (Doug Sampson, personal communication) and then again in 2006, this shift from temporary pond species to permanent pond species should not come as any surprise. This was most pronounced in the late season *Sympetrum* species at JLS and JLL. *Sympetrum ambiguum*, a temporary pond breeder, dominated in 2004 -- while *Sympetrum vicinum*, a permanent pond breeder, dominated these Delmarva Bays in 2006.

It should be noted that annual precipitation levels have generally remained at normal or above normal since odonate work has started at JL (see appendix 4). A below average precipitation year has yet to occur since the formation of the mitigation cells, thus the impact of a dry year on the odonates of Jackson Lane have not yet been recorded. It is likely that abnormally dry years play a significant role in the long-term ecology of the odonate populations at Jackson Lane.

Cell #2 had changed dramatically from a newly formed pond in 2004 but by 2006 was well on its way to becoming a stable healthy marsh. It is the only cell to show this change. Establishment of *Celithemis eponina* and *Enallagma geminatum* at cell #2 in 2006 reflect this change. Both of these species are indicator species of healthy marshes. Cell #2 currently has the look and feel of becoming a reasonably **long-term** freshwater marsh. The fate of this developing marsh will depend upon how well it can retain surface water during an abnormally dry year.

Three adult *Cordulegaster erronea* were seen on 11-July-2006. This is the first time this species has been recorded from the Eastern Shore of Maryland. Larval habitat is most likely East Broadway Branch but one can not rule out the small sandy tributaries of the

nearby Choptank River or Cow Marsh Creek. The adults were seen along the forest edges where they meet the mitigation fields. This species is listed as threatened in Maryland (S2) and although its larval habitat is likely adjacent to JL property, it is significant to note that the adults forage at JL.

These observed changes have little impact on the major conclusions reached in the Orr, 2004 report. However, the dry verses wet year predictions (Table 5) in the 2004 report assumed that extensive standing water in the spring would be the norm. The spring of 2006 showed that this assumption was incorrect. These tables will need to be revisited and expanded to consider the seasonal variations and not just the annual variations in hydrology that occur at Jackson Lane. In addition, as mentioned above, the Delmarva Bays in 2006 were not as receptive to temporary pond dragonflies such as *Sympetrum ambiguuum* as they were in 2004. The 2004 report suggested that *Sympetrum ambiguuum* would be a good indicator species for Delmarva Bays. This likely still holds for those years that the Delmarva Bays dry up late in the season, but as 2006 proved, in years that they retain water year around, *Sympetrum ambiguuum* numbers drop too low for this species to be relied upon as a good indicator species.

References

- Orr, R. 2004. *The 2004 Survey of the Dragonflies and Damselflies of Jackson Lane Preserve (Caroline County, Maryland)*. Report to The Nature Conservancy. 21pages
- Stachowicz J.J. and Tilman D. 2005. *Species Invasions and the Relationships between Species Diversity, Community Saturation, and Ecosystem Functioning*. Chapter 2 in *Species Invasions: Insights into Ecology, Evolution and Biogeography* Edited by Sax, Stachowicz and Gaines, publisher Sinauer Associates, Inc. 495 pages

APPENDIX 1

COMPLETE ODONATE SPECIES LIST (combined 2004 & 2006 field seasons) FOR JACKSON LANE PRESERVE

Those species marked with (+) represents new species records for Caroline County. Voucher specimens were taken for those species marked with an asterisk and if marked with (1) photographs were obtained.

Damselflies (19 species):	
<i>Calopteryx maculata</i> – Ebony Jewelwing (*)	<i>Lestes australis</i> – Southern Spreadwing (*) (+)(1)
<i>Lestes congener</i> – Spotted Spreadwing (*) (+)(1)	<i>Lestes forcipatus</i> – Sweatflag Spreadwing (*) (+)
<i>Lestes inaequalis</i> – Elegant Spreadwing (*) (+)	<i>Lestes rectangularis</i> – Slender Spreadwing (*)
<i>Lestes vigilax</i> – Swamp Spreadwing (*)	<i>Argia fumipennis violacea</i> – Violet Dancer (*)
<i>Enallagma aspersum</i> – Azure Bluet (*) (+)	<i>Enallagma basidens</i> – Double-striped Bluet (*) (+)
<i>Enallagma civile</i> -- Familiar Bluet (*)	<i>Enallagma divagans</i> -- Turquoise Bluet (*)
<i>Enallagma geminatum</i> – Skimming Bluet (*)	<i>Enallagma signatum</i> – Orange Bluet (*)
<i>Enallagma traviatum</i> -- Slender Bluet (*) (+)	<i>Ischnura hastata</i> – Citrine Forktail (*)
<i>Ischnura posita</i> -- Fragile Forktail (*)	<i>Ischnura ramburii</i> – Rambur’s Forktail (+)
<i>Ischnura verticalis</i> -- Eastern Forktail (*)	
Dragonflies (42 species):	
<i>Dromogomphus spinosus</i> – Black Shouldered Spinyleg (*) (+)	<i>Gomphus exilis</i> – Lancet Clubtail (*)
<i>Gomphus lividus</i> -- Ashy Clubtail (*) (1)	<i>Hagenius brevistylus</i> – Dragonhunter
<i>Aeshna umbrosa</i> – Shadow Darner	<i>Anax junius</i> -- Common Green Darner (*)
<i>Anax longipes</i> – Comet Darner (*) (+)	<i>Basiaeschna janata</i> -- Springtime Darner (*)
<i>Epiaeschna heros</i> – Swamp Darner (+) (*)	<i>Gomphaeschna antilope</i> – Taper-tailed Darner (*) (+)
<i>Gomphaeschna furcillata</i> -- Harlequin Darner (*) (+)	<i>Nasiaeschna pentacantha</i> – Cyrano Darner (+) (*)
<i>Cordulegaster erronea</i> – Tiger Spiketail (+)	<i>Cordulegaster maculata</i> -- Twin-spotted Spiketail (*) (+)
<i>Didymops transversa</i> – Stream Cruiser (*)	<i>Macromia illinoiensis georgina</i> – Georgia River Cruiser (*) (1)
<i>Epicordulia princeps</i> – Prince Baskettail (+)	<i>Somatochlora linearis</i> – Mocha Emerald (*) (+)
<i>Somatochlora tenebrosa</i> – Clamp-tipped Emerald	<i>Tetragoneuria cynosura</i> -- Common Baskettail (*) (1)
<i>Celithemis elisa</i> – Calico Pennant (*) (+)	<i>Celithemis eponina</i> – Halloween Pennant (+)
<i>Celithemis verna</i> – Double-ringed Pennant (*) (+)	<i>Erythemis simplicicollis</i> – Eastern Pondhawk (*)
<i>Libellula axilena</i> – Bar-winged Skimmer (+) (*) (1)	<i>Libellula cyanea</i> – Spangled Skimmer (*)
<i>Libellula deplanata</i> -- Corporal Skimmer (*) (1)	<i>Libellula incesta</i> – Slaty Skimmer (*)
<i>Libellula luctuosa</i> – Widow Skimmer	<i>Libellula lydia</i> -- Common Whitetail Skimmer (*) (1)
<i>Libellula pulchella</i> – Twelve-spotted Skimmer (*)	<i>Libellula semifasciata</i> – Painted Skimmer (*) (1)
<i>Libellula vibrans</i> – Great Blue Skimmer (*)	<i>Pachydiplax longipennis</i> – Blue Dasher (*) (1)
<i>Pantala flavescens</i> – Wandering Glider	<i>Pantala hymenaea</i> – Spot-winged Glider
<i>Perithemis tenera</i> – Eastern Amberwing (1) (*)	<i>Sympetrum ambiguum</i> – Blue-faced Meadowhawk (1) (*) (+)
<i>Sympetrum vicinum</i> – Autumn Meadowhawk (1) (*)	<i>Sympetrum rubicundulum</i> – Ruby Meadowhawk (*) (+)
<i>Tramea carolina</i> – Carolina Saddlebag (*)	<i>Tramea lacerata</i> – Black Saddlebag (*)

APPENDIX 2

LARVAL HABITAT (combined 2004 & 2006 field seasons)

Common Name	Genus	Species	State Rank MD	Larval Habitat (JL)	Larval Activity
Ebony Jewelwing	<i>Calopteryx</i>	<i>maculata</i>		Stream	C
Southern Spreadwing	<i>Lestes</i>	<i>australis</i>		Ponds, Bogs	C
Spotted Spreadwing	<i>Lestes</i>	<i>congener</i>	S3	Pools	C
Sweetflag Spreadwing	<i>Lestes</i>	<i>forcipatus</i>	S3	Ponds	C
Elegant Spreadwing	<i>Lestes</i>	<i>inaequalis</i>		Swamps, Ponds	C
Slender Spreadwing	<i>Lestes</i>	<i>rectangularis</i>		Pools, Swamps, Ponds	C
Swamp Spreadwing	<i>Lestes</i>	<i>vigilax</i>		Swamps, Bogs	C
Violet Dancer	<i>Argia</i>	<i>fumipennis</i>		Ponds, Swamps	C, S
Azure Bluet	<i>Enallagma</i>	<i>aspersum</i>	S3S4	Ponds, Marshes	C
Double-striped Bluet	<i>Enallagma</i>	<i>basidens</i>		Ponds, Marshes	C
Familiar Bluet	<i>Enallagma</i>	<i>civile</i>		Ponds, Marshes, Pools	C
Turquoise Bluet	<i>Enallagma</i>	<i>divagans</i>	S3S4	Stream	C
Skimming Bluet	<i>Enallagma</i>	<i>geminatum</i>		Ponds	C
Orange Bluet	<i>Enallagma</i>	<i>signatum</i>		Ponds	C
Slender Bluet	<i>Enallagma</i>	<i>traviatum</i>	S3	Ponds	C
Citrine Forktail	<i>Ischnura</i>	<i>hastata</i>		Ponds, Pools	C
Fragile Forktail	<i>Ischnura</i>	<i>posita</i>		Ponds, Swamps, Pools	C
Rambur's Forktail	<i>Ischnura</i>	<i>ramburii</i>		Ponds	C
Eastern Forktail	<i>Ischnura</i>	<i>verticalis</i>		Ponds	C
Black-shouldered Spinyleg	<i>Dromogomphus</i>	<i>spinosus</i>		SAO - from river	B
Lancet Clubtail	<i>Gomphus</i>	<i>exilis</i>		Stream, Ponds	B
Ashy Clubtail	<i>Gomphus</i>	<i>lividus</i>		Stream	B
Dragonhunter	<i>Hagenius</i>	<i>brevistylus</i>		SAO - from river	S
Shadow Darner	<i>Aeshna</i>	<i>umbrosa</i>		Stream	C
Common Green Darner	<i>Anax</i>	<i>junius</i>		Ponds, Pools	C
Comet Darner	<i>Anax</i>	<i>longipes</i>	S3	Ponds, Pools	C
Springtime Darner	<i>Basiaeschna</i>	<i>janata</i>		SAO - from river	C
Swamp Darner	<i>Epiaeschna</i>	<i>heros</i>		Swamps	C, S
Taper-tailed Darner	<i>Gomphaeschna</i>	<i>antilope</i>	S2	Bogs	C
Harlequin Darner	<i>Gomphaeschna</i>	<i>furcillata</i>	S3	Swamps	C
Cyrano Darner	<i>Nasiaeschna</i>	<i>pentacantha</i>	S3	Ponds, Swamps	C
Tiger Spiketail	<i>Cordulegaster</i>	<i>erronea</i>	S2	Stream	B, S
Twin-spotted Spiketail	<i>Cordulegaster</i>	<i>maculata</i>		Stream	B, S
Stream Cruiser	<i>Didymops</i>	<i>transversa</i>		Stream	S
Georgia River Cruiser	<i>Marcromia</i>	<i>illinoensis</i>		SAO - from river	S
Prince Baskettail	<i>Epicordulia</i>	<i>princeps</i>		SAO	C, S
Mocha Emerald	<i>Somatochlora</i>	<i>linearis</i>	S3S4	Stream	S
Clamp-tipped Emerald	<i>Somatochlora</i>	<i>tenebrosa</i>	S3S4	Stream	S
Common Baskettail	<i>Tetragoneuria</i>	<i>cynosura</i>		Ponds, Swamps	C, S
Calico Pennant	<i>Celithemis</i>	<i>elisa</i>		Ponds	C
Double-ringed Pennant	<i>Celithemis</i>	<i>verna</i>		Ponds	C
Eastern Pondhawk	<i>Erythemis</i>	<i>simplicicollis</i>		Ponds, Swamps, Pools	S
Bar-winged Skimmer	<i>Libellula</i>	<i>axilena</i>	S3	Pools, Swamps	S
White-spangled Skimmer	<i>Libellula</i>	<i>cyanea</i>		Ponds	S
Blue Corporal	<i>Libellula</i>	<i>deplanata</i>		Ponds	S
Slaty Skimmer	<i>Libellula</i>	<i>incesta</i>		Ponds	S
Widow Skimmer	<i>Libellula</i>	<i>luctuosa</i>		Ponds	S
Common Whitetail	<i>Libellula</i>	<i>lydia</i>		Ponds, Pools, Swamps	S
Twelve-spotted Skimmer	<i>Libellula</i>	<i>pulchella</i>		Pools	S
Painted Skimmer	<i>Libellula</i>	<i>semifasciata</i>		Ponds, Pools	S
Great Blue Skimmer	<i>Libellula</i>	<i>vibrans</i>		Ponds, Swamps	S
Blue Dasher	<i>Pachydiplax</i>	<i>longipennis</i>		Ponds, Pools, Swamps	S
Wandering Glider	<i>Pantala</i>	<i>flavescens</i>		Pools, Ponds	S
Spot-winged Glider	<i>Pantala</i>	<i>hymenaea</i>		Pools, Ponds	S
Eastern Amberwing	<i>Perithemis</i>	<i>tenera</i>		Ponds, Pools	S
Blue-faced Meadowhawk	<i>Sympetrum</i>	<i>ambiguum</i>	S3S4	Pools	S
Ruby Meadowhawk	<i>Sympetrum</i>	<i>rubicundulum</i>		Pools	S
Autumn Meadowhawk	<i>Sympetrum</i>	<i>vicinum</i>		Ponds, Bogs	S, C
Carolina Saddlebags	<i>Tramea</i>	<i>carolina</i>		Pools, Ponds	S
Black Saddlebags	<i>Tramea</i>	<i>lacerata</i>		Pools, Ponds	S

KEY: S1 = State Endangered
 S2 = State Threatened
 S3 = State watch list

Pools = temporary
 Ponds = permanent (including some ditches)
 SAO = Stray Adults only
 Bogs = acidic ponds only
 Swamps = Deep shaded Ponds (including some ditches)

B = Burrower
 S = Sprawler
 C = Climber

APPENDIX 3

SUMMARY OF HYDROLOGIC INDICATORS FOR SPRING OF 2006

http://www.mde.state.md.us/Programs/WaterPrograms/Water_Consevation/Current_Conditions/index.asp

Summary of Hydrologic Indicators for June 14, 2006					
Region	Rainfall	Stream Flow	Groundwater	Reservoirs	Overall Status
Western	Normal	Normal	Watch	Normal	Normal
Central	Normal	Watch	Watch	Normal	Watch
Eastern	Normal	Watch	Watch	N/A	Watch
Southern	Normal	N/A	Normal	N/A	Normal

Summary of Hydrologic Indicators for May 31, 2006					
Region	Rainfall	Stream Flow	Groundwater	Reservoirs	Overall Status
Western	Normal	Normal	Watch	Normal	Normal
Central	Normal	Watch	Watch	Normal	Watch
Eastern	Normal	Watch	Watch	N/A	Watch
Southern	Normal	N/A	Normal	N/A	Normal

Summary of Hydrologic Indicators for April 30, 2006					
Region	Rainfall	Stream Flow	Groundwater	Reservoirs	Overall Status
Western	Normal	Normal	Watch	Normal	Normal
Central	Normal	Normal	Watch	Normal	Normal
Eastern	Normal	Normal	Warning	N/A	Normal
Southern	Normal	N/A	Normal	N/A	Normal

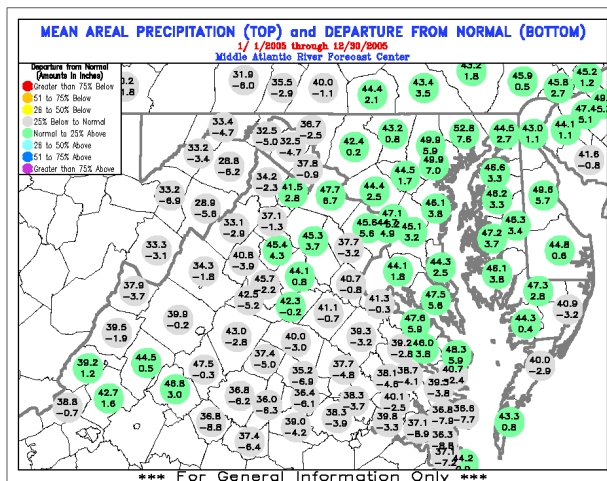
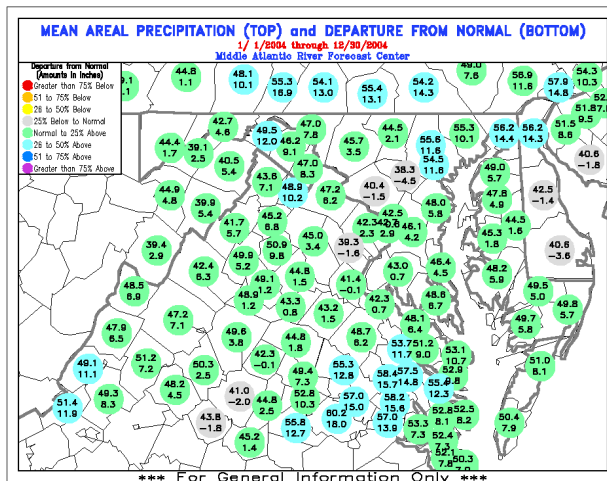
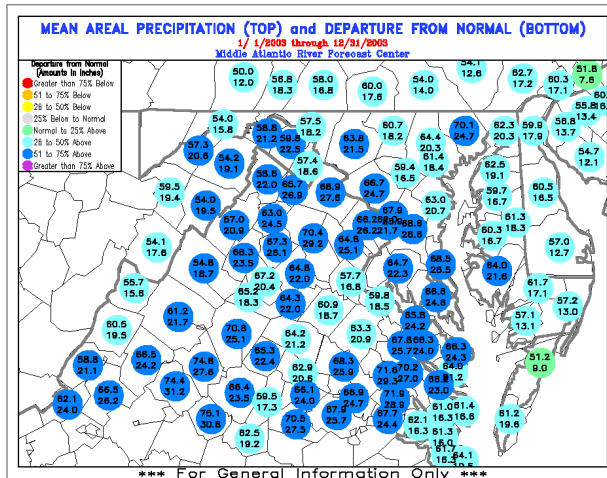
Summary of Hydrologic Indicators for March 31, 2006					
Region	Rainfall	Stream Flow	Groundwater	Reservoirs	Overall Status
Western	Normal	Emergency	Watch	Normal	Watch
Central	Normal	Warning	Normal	Normal	Normal
Eastern	Normal	Warning	Warning	N/A	Warning
Southern	Normal	N/A	Normal	N/A	Normal

Summary of Hydrologic Indicators for February 28, 2006					
Region	Rainfall	Stream Flow	Groundwater	Reservoirs	Overall Status
Western	Normal	Normal	Normal	Normal	Normal
Central	Normal	Normal	Normal	Normal	Normal
Eastern	Normal	Normal	Normal	N/A	Normal
Southern	Normal	N/A	Normal	N/A	Normal

APPENDIX 4

ANNUAL PRECIPITATION INFORMATION

<http://www.erh.noaa.gov/er/marfc/Maps/precip.html>



APPENDIX 5

BEE TRAP RESULTS (S. Droege 2005, R. Orr 2006)

Traps = 15 small cups with soapy water per day

ANDRENIDAE

<i>Andrena carlini</i>	19-April-2006
<i>Andrena cressonii</i>	19-April-2006
<i>Andrena violae</i>	07-April-2005
<i>Andrena</i> sp.	07-April-2005
<i>Calliopsis andreniformis</i>	31-May-2006

HALICTIDAE

<i>Agapostemon texanus</i>	19-April-2006
<i>Augochella aurata</i>	31-May-2006
<i>Augochlora pura</i>	19-April-2006
<i>Halictus ligatus/poeyi</i>	07-April-2005, 31-March-2006, 31-May-2006
<i>Halictus rubicundus</i>	31-May-2006
<i>Lasioglossum bruneri</i>	07-April-2005
<i>Lasioglossum admirandum</i>	07-April-2005
<i>Lasioglossum coreopsis</i>	07-April-2005
<i>Lasioglossum foxii</i>	31-May-2006
<i>Lasioglossum pilsum</i>	07-April-2005, 31-May-2006
<i>Lasioglossum rohweri</i>	07-April-2005, 03-May-2006, 31-May-2006, 19-April-2006
<i>Lasioglossum tegulare</i>	07-April-2005, 19-April-2006

MEGACHILIDAE

<i>Hoplitis pilosifrons</i>	31-May-2006
<i>Osmia atriventris</i>	07-April-2005, 19-April-2006
<i>Osmia pumila</i>	07-April-2005, 19-April-2006, 31-May-2006
<i>Osmia virga/proxima</i>	07-April-2005

APIDAE

<i>Bombus impatiens</i>	31-May-2006
<i>Ceratina dupla</i>	31-May-2006
<i>Ceratina stenua</i>	07-April-2005
<i>Eucera hamata</i>	31-May-2006
<i>Nomada bidentate</i>	07-April-2005
<i>Nomada lehighensis</i>	07-April-2005
<i>Nomada pygmaea</i>	07-April-2005