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ARGIA

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The Dragonfly Society Of The Americas

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Journals Published By The Society

ARGIA, the quarterly news journal of the **DSA**, is devoted to non-technical papers and news items relating to nearly every aspect of the study of Odonata and the people who are interested in them. The editor especially welcomes reports of studies in progress, news of forthcoming meetings, commentaries on species, habitat conservation, noteworthy occurrences, personal news items, accounts of meetings and collecting trips, and reviews of technical and non-technical publications. Articles for publication in **ARGIA** should preferably be submitted as hard copy and (if over 500 words) also on floppy disk (3.5″ or 5.25″). The editor prefers Windows files, preferably written in Word, Word for Windows, WordPerfect, or WordStar. Macintosh Word disks can be handled. **All files should be submitted unformatted and without paragraph indents**. Each submission should be accompanied by a text (=ASCII) file. Other languages should be submitted only as text (=ASCII) files. Line drawings are acceptable as illustrations.

T. Donnelly (address above) and Jim Johnson are the editors of **ARGIA.**

BULLETIN OF AMERICAN ODONATOLOGY is devoted to studies of Odonata of the New World. This journal considers a wide range of topics for publication, including faunal synopses, behavioral studies, ecological studies, etc. The **BAO** publishes taxonomic studies but will not consider the publication of new names at any taxonomic level. Enquiries and submission of manuscripts should be made to **BAO** editor, T. Donnelly, 2091 Partridge Lane, Binghamton NY 13903. Final submissions (after review) should be made on floppy disk, or as an e-mail attachment, as above, with illustrations in final form and preferably adjusted to final size.

Membership In The Dragonfly Society Of The Americas

Membership in the **DSA** is open to any person in any country. Dues for individuals in the US, Canada, or Latin America are $20 US for regular membership and $25 US for institutions or contributing membership, payable annually on or before 1 March of membership year. Dues for members in the Old World are $30 US.

Dues should be mailed to Jerrell Daigle, 2067 Little River Lane, Tallahassee, FL 32311

The **BULLETIN OF AMERICAN ODONATOLOGY** is available by a separate subscription at $20 US for members and $25 US for non-members and institutions.

Front cover: Valentine post card (see article by Ken Tennessen).

ARGIA — The News Journal of the D.S.A.

In This Issue

Our tumultuous year has ended with a whimper. The hurricanes have blown down many of our trees; the rains have left much of the country soaked; and now we have a long, cold wait until we again see wings sparkle in the spring sunshine and marvel at graceful jewels flying in the warm breeze.

We thought that the cover would bring a few smiles to our readers. Ken Tennessen found this old (and probably valuable) postcard.

The cold days of January are a good place to start with our customary reminder of trips yet to come. The dates of the Eglin AFB meeting are now firm. The Northeastern meeting has new accommodation information. Following our very successful first day of presentations in Iowa, the annual meeting in Ontario will feature a day of presentations, workshops, etc., and this issue contains an invitation to contribute to this session. The GLOM meeting has firm dates now. Now just say after me, "It will get warmer . . ."

We have lots of exciting things to report from last year's activities. First, we include here a short summary of the Southeastern meeting at Mammoth Cave, Kentucky last year. One of the most exciting reports in this issue is Carl Cook's account of a record for ***Aeshna mutata*** (Spatterdock Darner) for Nova Scotia. Not only is this a substantial range extension, but also the date of capture is amazingly late for this early summer species. George Harp contributes an account of Odonata collections in a wild area of Arkansas.

Marjorie Hughes reports on the first record of ***Stylurus amnicola*** (Riverine Clubtail) from Manitoba. Steve and Mary Jane Krotzer had a fine time in Mississippi and found lots of new things in that marvelous but under surveyed state. Ginger Brown reports that Rhode Island was not as gloomy as the rest of the northeast, and she had a fine summer.

Sue Gregoire reports on a mass emergence of ***Lestes unguiculatus*** (Lyre-tipped Spreadwing) in an artificial pond in upstate New York. And George Harp shows that ***Ischnura kellicotti*** (Lilypad Forktail) doesn't need to have those lily pads from which it got its common name.

Dave Small contributes an article about "Operation Rubyspot", which seeks to find out the present distribution of ***Hetaerina americana***, the American Rubyspot. Howe, in 1917, in what may be the very first North American dot-map, shows five dots for Maine and five for Massachusetts (with a note that it occurred in each of the six New England states). At present the species has been considered to be in decline, and the present survey seeks to find out about its status.

Roy Beckemeyer contributes the third part of his series on dragonfly flight, bringing us up to speed on pressure distributions on the wings. If you have been following the story, you will be starting to understand how dragonflies, and lots of other insects, manage to fly. And try his links at the end — they're cool.

Chris Beatty reports on a highly successful Odonata meeting in Ottawa last September. Paul Novak announces the formation of an Odonata survey for the state of New York. Paul McKenzie reports on the formation of a similar organization in Missouri to organize dragonfly data and the stimulate dragonfly studies. Let's get involved!

One of the more welcome and yet surprising things I found in my e-mail was a very fine dragonfly drawing that I reproduce in this issue. On a lighter note Ed Whisler tells us of a Pacific Forktail (***Ischnura cervula***) that visited the neighborhood convenience store.

We have two new books (one of them very old, in fact), and several newly published papers for your interest and perusal.

TRAMEA is really loaded this time. Roy Beckemeyer tells us of a truly remarkable web site for scientific illustration. I have looked at this site and found it remarkable for my own work. Bob Glotzhober tells us of the improved Ohio web site, and Bill Mauffray fills us in on the improved and expanded IORI web site — the granddaddy of them all.

About the Front Cover

Ken Tennessen

On the cover is a scan I made of an old postcard. It is a Valentine greeting, probably a very rare one, as it was printed by Raphael Tuck & Sons. Below is some information on Tuck I found on a web site (see especially the last paragraph). Looking at the postmark on the back, it appears to have been sent in February 1903, but I can't tell for sure. It is addressed to a young fellow (Master Norman Arnold) in Warren, Pennsylvania, from "Aunt Amanda". There is a 1 cent stamp on the back. The card was a gift to me from Dr. Paul Kittle, head of the Biology Dept. at the Univ. of North Alabama; he is a post card collector!

Raphael Tuck & Sons were publishers from the mid 1800s into the early 20th Century. They were proudly known to be the "Publishers to Her Majesties the King and Queen", with printing houses in London, Paris and New York. They began in London, England in 1866, selling pictures and frames. Raphael Tuck was joined by his three sons in 1871 and published their first Christmas greeting card. In 1893 they were granted a Royal Warrant by Queen Victoria. Adolph Tuck, one of the sons, produced their first picture postcard in 1894 of Mt. Snowden in Wales, which was sold to tourists visiting the site. The first series of numbered postcards was printed in 1898 and was a set of 12 lithographed vignette views of London, numbered 1 to 12, with the "Tower of London" being postcard #1. They entered the postcard market in the United States in 1900 with an office in New York. American artists designed many of the postcards, but the cards were printed in Europe (Germany, Saxony, England) and then returned to the states for sale.

Unfortunately, like the records of many other postcard printers and manufacturers of their time, the history, records, original paintings and postcards of Raphael Tuck & Sons were destroyed during the bombing blitz of London during World War II.

Raphael Tuck & Sons were prolific printers and produced Books, Postcards, Greeting Cards, Die Cut Cards, Fringed Silk Cards, Scrapbooks, Puzzles and more.

Eglin Adult Dragonfly Survey 25 – 27 March 2005

Theresa Thom, <theresa.thom@eglin.af.mil>, 350 Oak Tree Square, Athens, GA 30606-2223; 706-254-9537 (cell)

The 2005 Eglin Dragonfly Sampling Adventure is our last chance. It will take place on 25–27 March 2005.

Tentative agenda

25 March 2005 (Friday) 0730 hrs. (plan to carpool in 4WD vehicles): Meet at Jackson Guard, watch safety video, pick up group permits, then on our way! We will most likely try to sample at three to four sites, finishing around 1700 hrs (this is flexible, depending on hunger levels, weather and dragonfly activity).

26 March 2005 (Saturday) 0800 hrs. (plan to carpool in 4WD vehicles): Meet at Jackson Guard, on to three to four sites, also finishing around 1700 hrs., again flexible.

27 March 2005 (Sunday)? 0800 hrs.: Depending on die-hard folks and who wants to stay, may have time for one or two sites, but I will have to leave to head back to Georgia at high noon.

Note: So far, with our sampling efforts on Eglin, we have documented 79 species of Odonata from adult specimens collected on Eglin including Santa Rosa, Okaloosa and Walton Counties (the summary report will be published soon)! I am not sure how many new species we will find in 2005, but it is worth a try! We do want to focus our efforts for collecting ***Ophiogomphus*** to definitely determine if it is a new species. Again, I will provide reared specimens.

Hotel Information

We have enjoyed staying at the Regency Inn in Niceville—nice and not too expensive.

Regency Inn—Niceville, 4577 E. Highway 20, Niceville FL, 850-897-0600, 1-866-273-4362

2005 Northeast Regional Meeting, State College, Pennsylvania

Hal White <halwhite@udel.edu>

Although there is that lonely hint that a few wayward ***Anax junius*** may still be lingering in New York, I have hung up my net and am working on the 2005 northeast regional DSA meeting—arrive in State College, Pennsylvania, on the evening of Thursday, 9 June and depart Sunday, 12 June. As noted in the current issue of ARGIA:

Rendezvous in Central Pennsylvania for a historic gathering to celebrate half a century of near-continuous monitoring of Ten Acre Pond, of one of the richest odonate habitats in North America. Eighty-five species are known from this single locality. Almost single handedly and on a near weekly basis through the flying season, Clark Shiffer has surveyed the pond's dragonflies and damselflies for decades. Even in 2004, the 50th year of survey work, he recorded two species new to the pond and a record number of 70 species. Among the more than 50 species to expect in the second week of June are ***Aeshna mutata*** (Spadderdock Darner), ***Anax longipes*** (Comet Darner), four species of ***Leucorrhinia***, and nine species of ***Lestes.***

While Ten Acre Pond may be the most famous locality in Central Pennsylvania and the focus of this meeting, there are bogs, streams, lakes, and a variety of habitats where ***Tachopteryx***, ***Cordulegasters***, Gomphids, Cordulines, and many other interesting species may be found. With some cooperation from the weather and many people in the field at different places, it may be possible to approach 100 species during the meetings.

I have set up a web site at: <http://www.udel.edu/chem/ white/TAP.html>. It now contains accommodation information and other tidbits. I will be adding material as time permits.

Call for Presentations, Posters, and Workshops at the DSA Annual Meeting, Arnprior, Ontario, 8–12 July 2005

Saturday 9 July will be the day for presentations at the 2005 DSA meeting at Arnprior. If you are planning to make a presentation, please send an **abstract of less than 250 words** to Paul Catling < catlingp@agr.gc.ca> by 1 May 2005 so that it can be scheduled. It should also be sent to Nick Donnelly <tdonelly@binghamton.edu> so that it can be published in ARGIA prior to the meeting. Abstracts will also be made available to others in the Ottawa area who might want to hear the presentations. Presentations will be limited to 15 minutes in length, but, through special arrangement, longer presentations may also be scheduled. Also shorter presentations will be accommodated. An abstract is not needed for a very short presentation (5 minutes or less—such as an unusual observation or photo), but we would like to know about it for the schedule.

Note that the subject of presentations can range from an outline of the fauna of a local area, photographic presentation, monitoring, general biology, behaviour, ecology, and taxonomic problems. Please include: **title**, **address**, **e-mail**, and **phone**.

The abstract should be a concise summary of the presentation, including a statement of the problem, the methods used, and the results found. A small figure may accompany the abstract but may not be reproduced if unsuitable for reproduction. A few references may also be included and possibly one or two illustrations, but total space must not exceed one page. Please be aware that your abstract might attract the attention of people that would not otherwise attend the meeting.

PowerPoint projection facilities as well as standard slide projectors will be available.

Posters for display in the meeting room should be no larger than 3 feet × 4 feet.

There is also a possibility to schedule **workshops**, and anyone wishing to take responsibility for a workshop should contact Paul Catling.

Following dinner, there will be a general presentation: "Dragonflies in the Bigger Picture—The Natural History of the Algonquin Region", by Michael Runtz

GLOM Meeting at Fort Frances, Ontario, 15–18 July 2005

The dates for the GLOM (Great Lakes Odonata Meeting) has now been fixed at 15–18 July 2005. Further details will be provided by Bill Morgenstern <earthmoodsphoto@yahoo.com>. The initial announcement was in the previous issue of ARGIA.

Calendar of Events for 2005

Event	Date	Location	Contact
Eglin Mtg	25–27 March	Niceville, Florida	Theresa Thom <theresa.thom@eglin.af.mil>
SE Regional	27–29 May	Yazoo, Mississippi	Steve Krotzer; rskrotze@southernco.com
NE Regional	9–12 June	State College, Penn.	Hal White; http://www.udel.edu/chem/white/TAP.html
DSA Annual	8–12 July	Arnprior, Ontario	Paul Catling; catlingp@agr.gc.ca
GLOM	15–18 July	Fort Frances, Ontario	Bill Morgenstern; rrvalley@rainyriverfieldnaturalist.org

2004 DSA Southeastern Regional Meeting, Mammoth Cave, Kentucky, 10–13 June

Carl Cook

The 2004 DSA Southeastern Regional Meeting began with a gathering of participants on 10 June at the Cave Research Foundation in Hart County, Kentucky. The weather was hot and humid, and conditions were once again favorable for thunderstorm development. In fact, Kentucky experienced some very unsettled and severe weather in the weeks preceding the meeting, and Lexington recorded the wettest May on record. Consequently, the incomparable Green River was too high for wading, but some local ponds and the East and South forks of the Little Barren River, as well as the mainstem Little Barren, yielded a nice array of Kentucky odonates. Thirteen people made an appearance, some briefly, but we counted them anyway. Nick and Ailsa Donnelly were with us in spirit, if not in body, after some untimely vehicle trouble. The participants observed a total of 47 species (see below).

Meeting participants included:

Mary Jane and Steve Krotzer and Paul Miliotis (Ala.)
Mike Thomas (Connecticut)
Jerrell Daigle!!! (Florida!!)!!
Brenda Bacon, Mark Depoy, Doug Foster and Kurt Helf (Mammoth Cave National Park, Kentucky)
Bob Cumming and Sandy Garrett (Tennessee)
Carl Cook and Ellis Laudermilk (Kentucky)

A list of the 47 species observed by the meeting participants:

Calopterygidae: ***Calopteryx maculata*** (Ebony Jewelwing), ***Hetaerina americana*** (American Rubyspot)

Lestidae: ***Lestes eurinus*** (Amber-winged Spreadwing), ***L. rectangularis*** (Slender Spreadwing)

Coenagrionidae: ***Argia apicalis*** (Blue-fronted Dancer), ***A. fumipennis violacea*** (Variable Dancer), ***A. moesta*** (Powdered Dancer), ***A. tibialis*** (Blue-tipped Dancer), ***Enallagma aspersum*** (Azure Bluet), ***E. basidens*** (Double-striped Bluet), ***E. exsulans*** (Stream Bluet), ***E. signatum*** (Orange Bluet), ***Ischnura hastata*** (Citrine Forktail), ***I. posita*** (Fragile Forktail), ***I. verticalis*** (Eastern Forktail)

Petaluridae: ***Tachopteryx thoreyi*** (Gray Petaltail)

Aeshnidae: ***Anax junius*** (Common Green Darner), ***A. longipes*** (Comet Darner), ***Epiaeschna heros*** (Swamp Darner)

Gomphidae: ***Arigomphus villosipes*** (Unicorn Clubtail), ***Dromogomphus spinosus*** (Black-shouldered Spinyleg), ***D. spoliatus*** (Flag-tailed Spinyleg), ***Gomphus crassus*** (Handsome Clubtail), ***G. lineatifrons*** (Splendid Clubtail), ***G. lividus*** (Ashy Clubtail), ***G. quadricolor*** (Rapids Clubtail), ***Hagenius brevistylus*** (Dragonhunter), ***Stylogomphus sigmastylus***

Cordulegastridae: ***Cordulegaster obliqua*** (Arrowhead Spiketail)

Macromiidae: ***Macromia illinoiensis*** (Illinois River Cruiser)

Corduliidae: ***Epitheca princeps*** (Prince Baskettail), ***Neurocordulia yamaskanensis*** (Stygian Shadowdragon), ***Somatochlora linearis*** (Mocha Emerald)

Libellulidae: ***Celithemis elisa*** (Calico Pennant), ***C. fasciata*** (Banded Pennant), ***Erythemis simplicicollis*** (Eastern Pondhawk), ***Erythrodiplax minuscula*** (Little Blue Dragonlet), ***Libellula cyanea*** (Spangled Skimmer), ***L. incesta*** (Slaty Skimmer), ***L. luctuosa*** (Widow Skimmer), ***L. pulchella*** (Twelve-spotted Skimmer), ***L. vibrans*** (Great Blue Skimmer), ***Pachydiplax longipennis*** (Blue Dasher), ***Perithemis tenera*** (Eastern Amberwing), ***Plathemis lydia*** (Common Whitetail), ***Tramea carolina*** (Carolina Saddlebags), ***T. lacerata*** (Black Saddlebags)

Aeshna mutata Hagen (Spatterdock Darner) in Nova Scotia, a new Provincial Record, and Significant Range Extension

Carl Cook and **Derek Bridgehouse**

Previous to this record the known northern range limit of ***A. mutata*** was Maine in the United States, and in Canada it had been reported only from Ontario (Needham, Westfall & May, 2000). The Ontario record appears to be historical only, and because of the species' rarity in Canada it is rated as a category 2 At Risk species for that country. In Maine it has been collected as recently as 1998 (adult only, though at an appropriate habitat) in Oxford County, at Clays Pond, by Porter Road, south of Fryburg, 43.9833°N, 70.9556°W (P. Brunelle, pers. comm.).

The specimen was carefully compared with females of both ***A. multicolor*** and ***mutata*** and shows the unmistakable characters of ***mutata.*** A comparison with ***multicolor*** is necessary because of the find of an evident stray of multicolor from Martha's Vineyard, Massachusetts, which was determined by E.M. Walker.

Few persons would be likely to overlook, or fail to take notice upon encountering this, one of our most beautiful darners. With their intense blue eyes and body markings of a softer shade of blue it is doubtful they could remain concealed in any area for any length of time. We suggest this discovery is additional evidence in support of the widely observed trend of several other odonate species that appear to be extending their range further northward.

Describing this discovery (Bridgehouse):

> The collection location was near Eastern Passage (44.63°N, 63.50°W), Nova Scotia, the collecting site is along a clear-cut section of an abandoned railway line, now known as the Trans–Canada Trail. The trail runs parallel to Hines Road, which can be accessed from Caldwell Road (Cole Harbour) and Pleasant Street in Eastern Passage. This section of trail is often frequented by ATV and dirt bike enthusiasts. Two areas of aquatic habitat are adjacent to the trail, the first is at a bridge crossing a small marshy stream with margins overgrown by thick brush, the stream runs into small pond which overflows into a bull-rush vegetated marsh. The second wet habitat close to the trail is a stretch of boggy black spruce forest. Date of collection was September 13, 2003, only a single individual was observed, it was flying close to the first described habitat which is presumed to be the breeding site. The individual was captured with an aerial net for voucher purposes.

The late date of capture of the specimen is nearly as remarkable as the location. The latest date given in Needham, Westfall, and May is 29 August from Ohio. This is itself a very late date; the flight period of the species is generally over by the end of July.

It isn't possible to completely rule out the possibility that this could be a wind-blown vagrant, given the prevailing weather patterns of the region. However, the specimen is very fresh and without any tattering to the wings, and the nearby appropriate habitat, all strongly suggest the species is likely an established resident.

Reference

Needham, Westfall and May. 2000. Dragonflies of North America. Revised Edition, Scientific Publishers, Gainesville, Florida.

Odonata of the Lorance Creek Natural Area, Arkansas

George L. Harp

In the process of documenting the natural history of Odonata in Arkansas, I have often focused on relatively undisturbed areas, such as the System of Natural Areas, established by Arkansas Code Annotated §15-20-303. This system is managed by the Arkansas Natural Heritage Commission (ANHC). The ANHC kindly issued me a permit to survey the dragonflies of the Lorance Creek Natural Area during 2003–04.

This 294-acre Natural Area is approximately ten miles south of Little Rock, in Pulaski County, and is basically a deep swamp lying along both sides of Lorance Creek at the transition of the West Gulf Coastal Plain and Mississippi Alluvial Plain. This system is a mosaic of open water, cypress-tupelo gum, beaver ponds and sandy washes overlain with groves of swamp blackgum (Arkansas Natural Heritage Commission Annual Report 2003).

To my knowledge, the first Odonata species recorded from this Natural Area was ***Ischnura prognata.*** Herschel Raney observed an emergence of this species during April 2002 (Harp 2003). On 9 May 2003 I recorded the following species (asterisk denotes sight identification only): ***Calopteryx maculata****, ***Argia tibialis***, ***Enallagma divagans***, ***Epiaeschna heros***, ***Gomphaeschna furcillata***, ***Gomphus graslinellus***, ***Cordulegaster obliqua***, ***Erythemis simplicicollis****, ***Ladona deplanata***, ***Libellula cyanea***, ***Libellula incesta***, ***Libellula semifasciata***, ***Libellula vibrans****, ***Pachydiplax longipennis****, ***Plathemis lydia****. On 2 September 2004, I recorded the following: ***Calopteryx maculata****, ***Anax junius***, ***Somatochlora filosa***, ***Erythemis simplicicollis****, ***Libellula incesta****, ***Libellula vibrans****, ***Pachydiplax longipennis****, ***Pantala flavescens***, ***Sympetrum ambiguum***, ***Tramea lacerata****. The current list for Lorance Creek Natural Area numbers 21 species.

I have recommended that the ANHC consider two of the species recorded for this Natural Area for listing as S2 (fewer than ten known sites in the state). Westfall and May (1996) have reported that the furtive forktail, ***Ischnura prognata***, is poorly known and apparently uncommon throughout its range. It is known from only two sites in Arkansas (Harp 2003), and while Mr. Raney saw "some" individuals, at Lorance Creek, I saw only one individual at the Craighead County site. Although I have revisited the latter site a few times, I have not seen additional specimens of this species.

The fine-lined emerald (***Somatochlora filosa***), although found from New Jersey south and west to Texas, is never found in large numbers. A single individual was collected in Arkansas in 1980 (Harp 1983). Another single individual was collected at approximately the same spot, St. Francis River at Lake City, Craighead County, five years later. A single individual was collected in 1995 as it fed along the highway at Warren Prairie in Bradley County. The two individuals collected at Lorance Creek on 1 September 2004 bring the total number of specimens collected in Arkansas to five, to the best of my knowledge.

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Harp, G.L. 2003. First records for the USA and Arkansas. Argia 14(4): 3.

Westfall, M.J., Jr. and M.L. May. 1996. Damselflies of North America. Scientific Publishers, Gainesville, Florida. 649 pp.

First Records of *Stylurus amnicola* for Manitoba

Marjorie L. Hughes, Winnipeg, Manitoba <hughes_marjorie@hotmail.com>
Paul M. Catling <catlingp@agr.gc.ca>

On 5 and 6 July 2004, I (M.H.) accompanied my husband Colin Hughes on his water quality survey route with the hope of finding some early summer clubtails. I was rewarded with several specimens, the most interesting of which was a teneral adult Riverine Clubtail, ***Stylurus amnicola.*** It was found resting in

Table 1.

Date (2004)	Locality	Type: exuviae (ex) or adult (ad)	Location
1 July	Assiniboine R., SE of Lavenham	2 ex	49.75980°N, 98.64260°W
4 July	Assin. R. at Hwy 34 near Holland	1 ex	49.70040°N, 98.90131°W
4 July	Winnipeg (The Forks)	2 ex	49.88722°N, 97.12703°W
6 July	Assin. R. at Hwy 34 near Holland	1 ex	49.69959°N, 98.90054°W
6 July	Portage la Prairie	5 ex	49.94926°N, 98.32352°W
6 July	East of Portage la Prairie	2 ex	49.96932°N, 98.09763°W
6 July	Headingly (bridge)	1 ex	49.86900°N, 97.40472°W
6 July	Headingly (Lido Plage)	1 ad	49.87410°N, 97.51110°W
7 July	Winnipeg (Assiniboine Park)	1 ex	49.87353°N, 97.24516°W
9 July	Headingly (Westmore River Park)	1 ex, 2 ad	49.86275°N, 97.37696°W
24 July	Winnipeg (Maple Grove Park)	1 ad	49.79412°N, 97.12625°W

tall grass about 50 m from the Assiniboine River at Headingly, which is just west of the city of Winnipeg, Manitoba. This species has never been reported from Manitoba (Hughes & Duncan 2003) but is known from northern Minnesota (Donnelly 2004). It is considered "unusual" in the North Woods area (Mead 2003).

The Assiniboine River flows southeast from its source in Saskatchewan towards the city of Brandon, Manitoba and then east to Winnipeg where it joins the Red River at the historic "Forks". The absence of any significant surface relief in south-central Manitoba allows the river to meander extensively. Most of this fertile plain is prime agricultural land sown in wheat, canola, vegetables and other crops but the banks of the river still support a remnant of river-bottom forest (Marsh 1988) and in some places Burr Oak woodlands extend along the banks.

At the town of Portage la Prairie there is a dam which acts as a control structure for a river diversion north to Lake Manitoba. Below this dam the water is quite fast and it is a popular spot for recreational fishing. It must be a popular spot for clubtails too because large numbers of exuviae were found on the sandy riverbanks in this area. Both ***Stylurus amnicola*** and ***S. notatus*** exuviae were found on 6 July with a ratio of five ***S. amnicola*** to one ***S. notatus***. On a subsequent visit to the same area 2 August 2004, 18 ***S. notatus*** exuviae were found but no ***S. amnicola***.

By a strange coincidence the second author (P.C.) was also searching the banks of the Assiniboine River the first week of July. He also was rewarded with finds of ***S. amnicola*** exuviae near the towns of Lavenham 1 July 2004 and Holland 4 and 6 July 2004. These locations are southwest of Portage la Prairie. He also found exuviae on the banks of the Red River in Winnipeg, just north of The Forks on 4 July 2004.

Further searches of the Assiniboine R. were carried out in hopes of finding more Riverine Clubtails. Exuviae were found at two more spots on the banks of the Assiniboine, just east of Portage la Prairie and in the Winnipeg area, in Assiniboine Park (Table 1). Two more adults, a young male and a young female, were found resting in a sunny glade of tall grass and weeds adjoining a remnant patch of riverbottom forest known as "Westmore Natural River Park" at Headingly.

A fourth adult, a female, was caught 24 July 2004 in Maple Grove Park, a recreational riverbank park on the Red River flood plain at the south end of Winnipeg. This individual was found resting on a dogwood shrub about 1.5 m above the ground in a warm sunny spot. This location is about 13.7 km south of where the exuviae were found at The Forks.

The final count, summarized in Table 1, is four adults and 16 exuviae from 11 locations on two rivers. The Assiniboine River locations span a distance of 127 km west to east.

All the adult specimens were captured alive and allowed to mature in captivity for several days. They were then killed, treated in acetone, and pinned. Ten of the exuviae were washed in a weak detergent solution, dried, mounted on cardboard points and pinned. Four exuviae and three adults were donated to the J.B. Wallis collection at the University of Manitoba in Winnipeg and three exuviae were placed in the Canadian National Collection (CNC) of Agriculture and Agri-Food Canada in Ottawa.

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Mississippi Flooded—2004 in Review

Steve Krotzer <rskrotze@southernco.com>

Collecting in Mississippi during 2004 was, in a word, wet!!! Mary Jane and I made five separate excursions to the Magnolia State during the collecting season, for the purpose of filling in some of the many holes in the distributional data of Mississippi odonates. We were able to get to 14 counties between March and August, before the seemingly non-stop tropical storms of the fall wiped out the rest of the collecting year. But even earlier in the year, Mississippi was beset by repeated heavy rainfall events, resulting in the streams being flooded or very high every time we were there. Consequently, we were forced to concentrate our fieldwork at lakes and in open areas near the streams. Fortunately for us, most of the counties we visited had few (if any) records, so obtaining voucher specimens of common species was a most worthwhile endeavor—and we did a lot of that!

One good thing about collecting in Mississippi is that, even if it seems that you're spending all your time chasing ***Erythemis simplicicollis*** and ***Pachydiplax longipennis*** for the county record, there are enough "goodies" scattered around that you will run across something interesting, unexpected, or both. For example, in March, amongst all the typical ***Epitheca costalis*** and ***E. cynosura*** flying about in Noxubee County, I got a couple of males that appear to be typical ***E. costalis***, but with extensive hindwing maculation as in ***E. cynosura***. I've never seen this before; maybe some of the old veterans more familiar with ***Epitheca*** can shed some light on this for me! And though gomphids are not especially diverse in this corner of the world, we did come across ***Arigomphus submedianus***, ***Dromogomphus spoliatus***, ***Erpetogomphus designatus***, and ***Stylurus laurae***, in addition to the more ubiquitous ***Gomphus exilis*** and ***Aphylla williamsoni.***

We found ***Cordulegaster obliqua*** at two sites, and ***Anax longipes*** at one. We discovered a large population of ***Somatochlora tenebrosa*** and found ***S. linearis*** also. Among the common damselflies for the area, such as ***Ischnura posita***, ***I. hastata***, and ***Argia apicalis***, were mixed in the occasional ***Enallagma dubium***, ***Nehalennia integricollis***, and even one ***Ischnura prognata***. We found ***Enallagma durum*** at two separate lakes, both a distance from the coast, and neither of which seems to fit the habitat requirements for the species. And lest I forget to mention it, Jason Bried came up with two new state records for Mississippi in 2004, and Mary Jane and I have collected a third. (We're holding on to those records until we publish the Mississippi paper, but I can tell you that two of the species are not unexpected, but the other one is, and may be related to all the hurricane activity we had in Mississippi this past fall.)

For those of you thinking about joining us at Yazoo City in 2005, I'm guessing that things will be very similar to what Mary Jane and I experienced this past year (hopefully without all the flooding, though!). Lots of counties with few records, so collecting even the most common species will be worthwhile in terms of documenting their presence in each county. And, while we're out there chasing all the common stuff, there should be enough of the unusual/unexpected out there to keep things interesting—maybe even another state record!

Brief Summary Report From Rhode Island

Virginia Brown

The 2004 odonate season in southern New England proved to be rich in both diversity and abundance of dragonflies and damselflies. Unlike 2003, when it rained almost continuously in the spring and late summer, weather conditions in 2004 were excellent for sun-loving insects. In Rhode Island, this year

will always be remembered for the abundance of two southern skimmers, which made their way into southern New England in large numbers. Bar-winged Skimmers (***Libellula axilena***) and Great Blue Skimmers (***Libellula vibrans***) moved into our area in June. Prior to this year, there was only one record for each in Rhode Island: 1995 for ***Libellula axilena*** and 1996 for ***L. vibrans***. In 2004 however, Great Blue Skimmers were recorded in 13 townships at 13 different locations and Bar-winged Skimmers were recorded in 11 townships at 12 different locations, including well north and west in the state. Reproductive behavior was observed in both species at numerous ponds and vernal pools. However, many of these sites dried up during June and July and the success of any eggs and/or larvae remains a question. ***L. axilena*** and ***L. vibrans*** were also reported from Connecticut and Massachusetts.

Despite the abundance of the two southern King Skimmers, Taper-tailed Darners (***Gomphaeschna antilope***) were scarce in 2004. This species is seen sporadically in Rhode Island, but observations have increased in number and regularity in the past three years. Only a few animals were observed in two different locations in 2004. Coppery Emeralds (***Somatochlora georgiana***) were again observed in large numbers in the Great Swamp Management Area, but two new populations were found in the higher elevations along our northern and western borders.

Surveys on urban river in Rhode Island produced intriguing results in 2004. Arrow Clubtails (***Stylurus spiniceps***) were found in a third location on the industrial Blackstone River in North Smithfield, only a few hundred yards from the Massachusetts line. The three sites for ***S. spiniceps*** on the Blackstone encompass five miles of river. Downstream from here on the Blackstone, the largest population we have seen of this species occurs in the rapids below a dam on algae and silt covered rock and cobble substrate. The species is well-established here in water of poor quality that has not yet improved to the "swimmable" category and that almost always has a very unpleasant odor. In addition to ***S. spiniceps***, the Blackstone River below this dam in Ashton supports a surprising diversity of river odonates including but not limited to: Spine-crowned Clubtail (***Gomphus abbreviatus***), Black-shouldered Spinyleg (***Dromogomphus spinosus***), Dragonhunter (***Hagenius brevistylus***), American Rubyspot (***Hetaerina americana***), and all four of our ***Argia*** species (***A. apicalis***, ***A. fumipennis***, ***A. moesta***, ***A. translata***).

Several new populations of the beautiful American Rubyspot (***Hetaerina americana***) were documented in 2004 on urban stretches of two Rhode Island rivers (Pawtuxet and Ten Mile) where little or no riparian buffer remains. Not only was the species present at these urban sites, but it was present in very large numbers and apparently thriving in less than pristine conditions. On the Pawtuxet River, which flows past several sewage treatment plants, ***H. americana*** was abundant where only a few scattered trees break up the asphalt that is the dominant feature of the riparian area.

With the Rhode Island Odonata Atlas project now officially complete, we are searching existing collections and databases for Rhode Island records, both current and historic. If any readers have collected in Rhode Island or know of someone who has, we would greatly appreciate knowing about those records.

Mass Emergence of *Lestes unguiculatus* in a Small Pond in Central New York

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Since at least the summer of 2001 there has been a large and very local population of ***Lestes unguiculatus*** (Lyre-tipped spreadwing) on our 60-acre property in the Finger Lakes region of New York State. There are ten ponds of various sizes and depths, from shallow woodland vernal to an 18-foot deep swimming pond. In the early part of each season, ***L. unguiculatus*** has been the dominant species at each one. This year, 2004, we explored a pond we usually ignore as it is out of the way in a far corner of a field. What we found there was a thrill. The following is an excerpt from Sue's field notes.

> June 3, 2004. Set out to do a survey of ponds on our property. On the approach to the little vernal pond in one of our fields, hundreds

of teneral damselflies floated up from the vegetation in the unmown path to the pond. I walked very slowly and carefully as clouds of tenerals rose up before me. With each tiny step, I was displacing at least 10 to 15!

At the pond, hundreds more were emerging as I watched. They were in every stage from just crawling out of the water to launching off on their maiden flight. After collecting some exuviae, which were piled one atop another on every stem of emergent vegetation, I left by another route and counted just as many per step. An estimate was in the tens of thousands.

Back home, examination of the exuviae all proved to be those of ***Lestes unguiculatus***, the vast majority of which were females.

June 10, 2004. A cold and drizzly day, with huge numbers still emerging.

June 12, 2004. Did a transect to get a better idea of just how many ***L. unguiculatus*** had emerged from this pond. Began to see thick presence 54 meters from the pond and started to count those within a square meter of my path. The computed average was 30 per square meter in suitable habitat with an overall presence of over 45 thousand tenerals on this day alone! (Emergence was to last another three days, adding to the number)

This pond is quite small, just 15 × 30 meters and only knee deep when full. It usually dries up in the summer, but maintained a small puddle all last year. Vegetation consists of a cattail patch, sedges, bur marigold and duckweed. It is bordered on one side by a stand of larch trees and on three sides a fallow field dominated by asters, goldenrods multiflora rose and gray-stemmed dogwood.

June 16, 2004. Pond receding and mass emergence over. Some of the tenerals beginning to color up and look like adults. Both males and females now, in various stages of maturity.

June 27, 2004. Another transect with just as many as before, despite the fact that a family of Kingbirds has discovered them.

July 2, 2004. Pond reduced to only 8 meters square. Most are now adults and dispersal has begun. Found a few adult males at each of the other ponds on our property but none at any neighboring ponds on other nearby properties.

July 5, 2004. Dispersal pretty much over, with only a few hundred at the vernal pond. Thousands have moved to a smaller, deeper pond about 100 meters away and are actively ovipositing there. (This is when I decided to mark some to study further dispersal and longevity. In the period from July 5 to Aug. 3, I marked 238 males and 99 females. Of those, none were ever seen at any of the other ponds, although one pair was seen ovipositing in my herb bed 75 meters from any water.)

August 1, 2004. Rain filled the vernal pond again. There were approximately 2,000 in close to the pond, mostly single males with a few tandem pairs. None were marked. Others still concentrated in the pond 100 meters away.

August 16, 2004. Activity slowing down. Only 20 males with one pair ovipositing at the vernal pond. There were another 20 at the second pond, a few of which were marked.

September 6, 2004. Only a few in the vernal pond, none marked. One lonely marked male in the second pond. He was the last of his kind.

October 10, 2004. Plenty of water in vernal pond as well as the smaller pond nearby. With luck the water will hold over the winter and into the spring.

By observing this population over the course of a season several points were evident: 1) the incredible number that survived a winter and spring in such a small amount of water; 2) the amount of time it took for the tenerals to reach adulthood—from three weeks to one month; 3) the short distance taken in dispersal; and 4) longevity in the adult stage—another month. We look forward to continuing this study next season and beyond.

Ischnura kellicotti and Lily Pads

George L. Harp

Williamson (1900) first reported the apparent obligatory relationship between ***Ischnura kellicotti*** Williamson (lilypad forktail) and a water lily, *Nuphar* (spatter dock). The complete life cycle of lilypad forktails occurs about the lily pads. The larvae cling to the ventral surfaces and emerge on the dorsal surfaces, while adults typically perch and oviposit only on lily pads (Johnson and Westfall, 1970). I personally have never seen an adult of this species perch on anything but lily pads, even at lakes where several pads touched the shoreline.

Harp (1983) first reported the lilypad forktail being associated with *Nymphaea odorata* Ait., the sweet-scented water lily. The site was a lake at the western city limit of Camden, Ouachita County, Arkansas. Subsequently, Harp (2000) reported the occurrence of the lilypad forktail at two sites in Missouri. At one of those sites, a lake in Howell County, the association was with a pink variety of *Nymphaea*, while the other site, a lake in Iron County, had *Nuphar*.

In retrospect, the association with *Nymphaea* probably should not be surprising. *Nymphaea* has leaves (lily pads) that are similar in size to those of *Nuphar*. Further, the leaf stems of both species are similar in rigidity, allowing the floating leaves to rise and fall synchronously with the changing water level.

On 15 June 2004 I found the lilypad forktail in association with *Brasenia schreberi* Gmel., water shield, at a lake in Fulton County, Arkansas. Like *Nuphar* and *Nymphaea*, its floating leaf also follows the changing water level. While some botanists consider it to be in the water lily family, Nymphaeaceae, most place it in Cabombaceae. This association was surprising for at least two reasons, however. First, the stem and the underside of the leaves of *Brasenia* are covered by a heavy mucilaginous jelly. It seems logical to hypothesize that the coating would be disadvantageous to ***I. kellicotti*** larvae, as well as interfering with oviposition. In addition, the water shield leaf is much smaller. Although I did not quantify the population density, my impression was that, while individuals were widespread, their numbers per unit area were noticeably fewer at this lake than I was accustomed to observing elsewhere. The association of the lilypad forktail with *Brasenia* may be a tenuous one.

The American lotus, *Nelumbo lutea* Willd., may be another plant with which the lilypad forktail could be associated. However, the rigidity of stem in this species results in the leaves being emersive more often than floating.

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Operation Rubyspot 2004

Dave Small

American Rubyspot ***Hetaerina americana*** is an elegant damselfly which had been recently reported in only four watersheds in Massachusetts. Members of the Athol Bird and Nature Club (ABNC) became interested in ***H. americana*** when a robust population was located on the Millers River in Athol.

With the help of a small research grant from the Massachusetts Natural Heritage and Endangered Species Program (MNHEP) ABNC set out to provide distribution data to enable the assessment of the regional status of the American Rubyspot, currently a "watch listed" species in Massachusetts. To engage the public in our search for the American Rubyspot, we designed and distributed "Wanted Posters" in the form of a full color flyer that provided reporting information. These

were distributed to Mass Audubon Centers, Trout Unlimited and other interest groups.

We provided observers the reward of having their sightings and photographs posted on our American Rubyspot web site <http://www.rubypspot.net>. The web site now makes it easy to answer the question: "Where in the Northeast were American Rubyspots in 2004?" Rubyspot updates were distributed during the flight season (August to October) to Northeast Dragonfly listserves to maintain the project energy. ABNC hopes to collect additional information for 2005 flight season through the web site.

A major component of the project was testing the use of various outreaches and reporting strategies to engage interest in odonate study. Observers were able to report sightings through the Rubyspot web site, by e-mail, mail, fax, or phone. This process provided useful groundwork for developing strategies for future statewide Massachusetts odonate atlas and survey work.

Volunteers surveyed 33 Massachusetts rivers and resulted in the discovery of American Rubyspot populations in 13 of these rivers across Massachusetts. Information from observations in Maine, Pennsylvania, New Hampshire, Vermont and Rhode Island were also collected and used to help refine search criteria. Most populations were found in relatively clean rivers with shallow riffles and wide flood plains. Several urban sites were discovered, thanks to tips from our Rhode Island neighbors, while areas below dams seem especially attractive to ***H. americana***. Review of the project data by MNHESP will help them assess the conservation status of this species in Massachusetts.

This project would not have been possible without the aid of the volunteers listed below and the wonderful age of internet communications which allowed the energy of the search to flow throughout the Northeast: Maria Aliberti, Ed Armstrong, Earle Baldwin, Christy Barnes, Elise Barry, Rinky Black, Chris Buelow, Virginia Brown, Emily Brunkhurst, Ron Cloutier, Sue Cloutier, Glenn Corbiere, David Fitch, Tom Fiore, Nancy Goodman, Lula Field, Karro Frost, Christopher Gentes, Lynn Harper, Shelley Hight, Pam Hunt, Janice LaPointe, Julie Lisk, Jennifer Loose, Jan McNamara, Joanie McPhee, Scott McPhee, Bob Moul, Fred Morrison, Tom Murray, Bryan Pfeiffer, Elaine Pourinski, Fred SaintOurs, Lilly Serrentino, Pat Serrentino, Michelle St. Sauveur, and Michael Veit.

Aerobatic Anisoptera & Zooming Zygoptera: Odonata Flight from A to Z

Roy Beckemeyer

Part 3. Dragonfly wings: Responding to pressure (continued).

In the last installment we learned that the pressure of the air that provides the aerodynamic lift on gliding wings is not distributed uniformly from costal margin to trailing edge, but is highest near the leading edge of the wing. The structure of wings reflects this anterior positioning of the lift in the clustering of the major longitudinal veins and their corrugations near the costal margin. Fig. 1 depicts the pressure distribution as it might appear on a dragonfly wing cross section, with the pressure below atmospheric above the wing and above atmospheric below the wing.

In Fig. 2, I have added to the picture two lines terminated by arrowheads. The first is a nearly vertical line directed upward and labeled "Total Aerodynamic Force". It originates at the "quarter-chord" point, 25% of the way from the leading edge of the wing, which is called the "center of lift" of the wing and is the point at which the net effect of the aerodynamic pressure distributed over the wing can be considered to act. The arrow itself is called a "force vector", and is a line for which both its length and its direction are representative. The line length represents the total amount of aerodynamic force (in Newtons) generated by the pressure acting on the wing. The direction of the line indicates the direction in which the force acts. This force is the net result of the pressure distribution, and is essentially equivalent to the pressure distribution in mechanical terms. The second line is horizontal, and is labeled "Velocity". This is the "Velocity Vector", and, again, the length of the line represents the speed of the wing through the air (or, equivalently, of the air moving past the wing), e.g. in meters per second, and the direction the direction in which the air is moving.

Now, just as we can effectively replace the pressure distribution on the wing by an equivalent aerodynamic force vector acting at the center of lift, we can also

represent the total force vector by two other vector forces, one acting in a direction parallel to the velocity vector, and one in a direction perpendicular to the velocity vector. This is shown in Fig. 3, where we have labeled the vector parallel to the velocity as the "Drag" force, and the vector perpendicular to the velocity as the "Lift" force. The two mutually perpendicular vectors that add up to the total aerodynamic force vector are called force "components", and resolving the total force into components in line with and at 90 degrees to the velocity vector and calling them drag and lift, respectively is the standard way of depicting the net aerodynamic force on a wing.

Now let's look at the way the air pressure supporting the insect in flight varies along the wing length, or span, from base to tip. One way to picture this would be to draw lots of wing cross sections adjacent to one another along the wing from base to tip as in Fig. 4a, and to imagine that each section is actually adjacent to the two adjoining sections so that the pressure distribution is continuous. An equivalent way to depict the wing would be to show the sections adjacent to one another, but with the aerodynamic forces shown rather than the pressure distribution, as in Fig. 4b.

If we were to choose any point along the wing span, for example, somewhere near the middle of the wing, we would see that the inboard and outboard sections had the same pressure distribution, so the constant pressure distribution along the span makes sense. But as we near the end of the wing, this distribution no longer holds. At the wing tip, the wing surface ends and there is nothing to keep the positive pressure below the wing from leaking around the tip to the top where the pressure is lower. This results in a net flow of air toward the wing tip beneath the wing and toward the wing base above the wing at the tip, and a rotational flow around the tip as shown in Fig. 5.

This leakage of pressure would result in the pressure distribution decreasing near the wing tip, so that this region supports less of the weight of the insect. The spanwise pressure distribution would thus look more like Fig. 6 than Fig. 4a.

The leakage of pressure from below to above the wing near the wing tip also results in a movement of air around the wing tip. Fig. 7 shows the air movement from below to above around the wing tip. Not shown in this picture is the movement of air past the wing from front to rear. If we add these two flows together, we find (Fig. 8) that the air flow beneath the wing

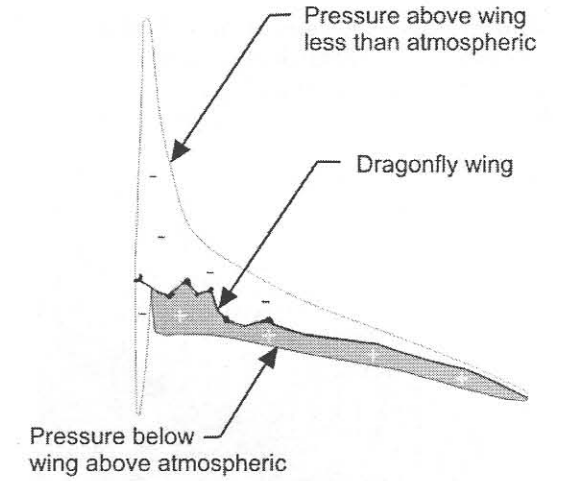


Figure 1. Pressure distribution over dragonfly wing cross section. The wing is at an angle of attack, so the pressure near the leading edge is below atmospheric both below and above the wing, but is much lower above the wing, so the net pressure is upward. On the remainder of the wing (roughly the subcosta to the trailing edge), the pressure below the wing is above atmospheric, while that above the wing is below atmospheric.

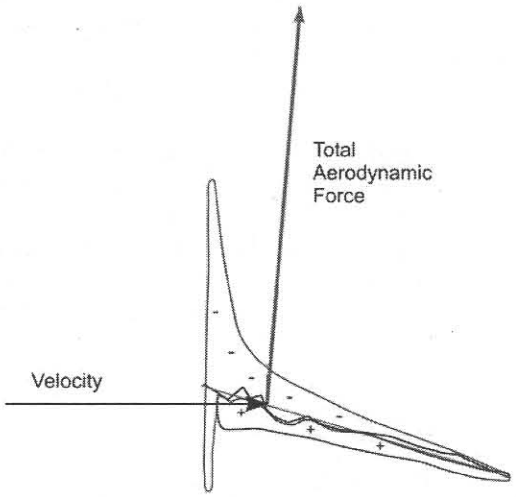


Figure 2. Here we have added to the dragonfly wing cross section and pressure distribution two arrows. The horizontal one represents the incident airflow (either from air moving past the wing or the wing moving through the air). The arrowhead on the line indicates that the line is a "vector" quantity—it designates both a magnitude (so many meters per second for each inch of length) and a direction. In this case the velocity is horizontal and to the right. The total aerodynamic force is directed upwards and a bit to the right. The length of the arrow would represent so many Newtons per inch of length on the drawing, and the direction indicates the direction in which the force acts. The total aerodynamic force is the net result of the pressure distribution, and is mechanically equivalent in terms of supporting the weight of the insect.

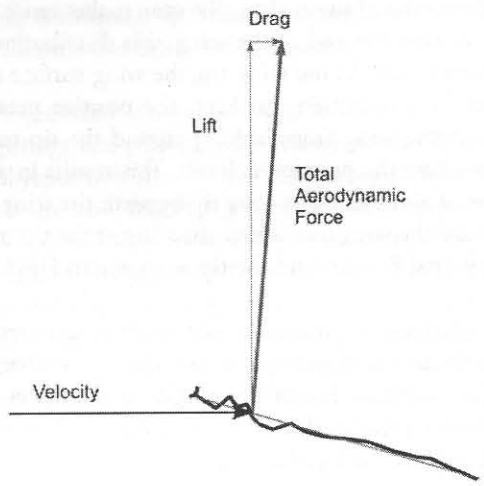


Figure 3. Here we have removed the pressure distribution, leaving the force vector and velocity vectors in place. We have also added two vectors, one parallel to the velocity vector (called Drag), and one perpendicular to the velocity vector (called Lift). The two mutually perpendicular vectors are the mechanical equivalent of the Total Aerodynamic Force vector.

(gray arrows) is deflected toward the wingtip while the airflow above the wing (black arrows) is deflected toward the wing base. The net flow twirls around itself, forming what is called the wing tip vortex.

The developed tip vortex looks like a miniature "tornado" that originates at the wing tip and extends downstream behind the wing, as shown in Fig. 9. The trailing vortex extends far behind the wing, and persists for a long time (vortices are very effective at transferring momentum in fluids). Some photographs

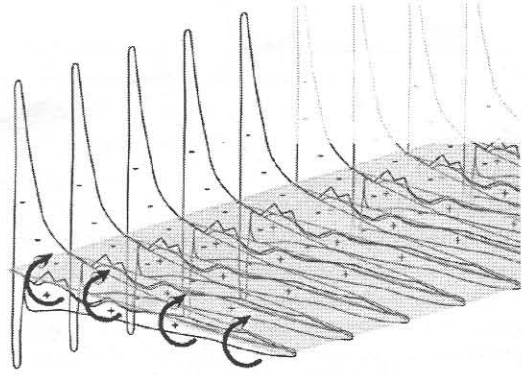


Figure 5. A close up of the tip of the wing with the pressure distribution represented as in Fig. 4. We can see that there is nothing separating the high pressure below the wing from the low pressure above the wing to the left of the wingtip, so there will be a flow of air from below to above the wing at the wingtip, lowering the pressure below the wing and increasing the pressure above the wing in the vicinity of the tip.

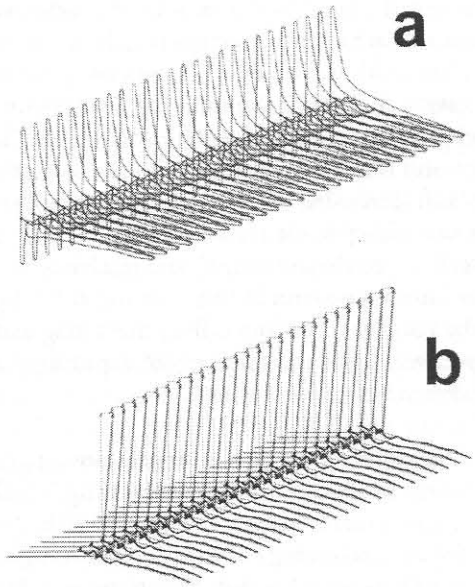


Figure 4. Here we have represented a dragonfly wing by showing a lot of cross sections spread over the length of the wing from base to tip (assuming the wing width or chord is constant and not tapered for now). We could envision this as representing the three dimensional pressure or force distribution over the entire wing. Fig. 4a shows the pressure distribution and Fig. 4b the force distribution over the wing.

of airplanes in flight in conditions in which their trailing vortices are rendered visible may be found on the efluids.com web site: (References, links 1 to 4).

Vortices are key structures in the flight of insects, and we will look at other kinds of vorticity and other vortex structures associated with wings in future install-

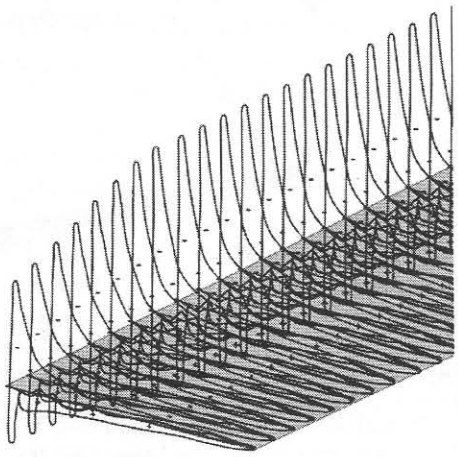


Figure 6. The result of the "leakage" of pressure around the wing tip is a lowering of pressure as one gets close to the tip. The resulting pressure distribution might look like this.

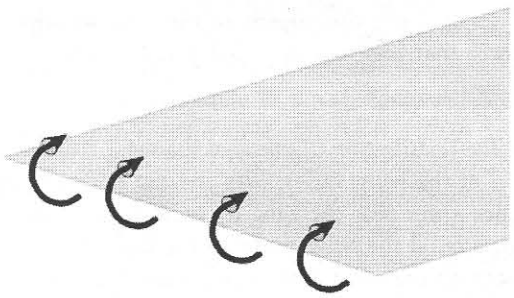


Figure 7. The flow around the wing tip shown without the pressure distribution, and without the incident airflow velocity.

ments of this series. For now, let's make one further observation about the spanwise distribution of pressure and air forces near wingtips. The tip vortex causes the air near the tip of the wing to flow downward. If we add this downward component to the incident airflow velocity, as shown in Fig. 10, we see that the effective angle of incidence of the airflow at the wingtip is less than that near the wing base. Thus the wing lift, the component of the aerodynamic force that is parallel to the local airflow vector, is effectively tilted backwards with respect to the lift vector for segments of the wing near the base (Fig. 10). Thus the lift force at the wing tip produces an effective small amount of extra drag, called the induced drag. Early aerodynamics researchers were able to show that it is possible to minimize the total induced drag for a wing by choosing an appropriate wing shape. In fact, it was shown that if the variation of the wing chord with span was elliptical, the induced drag would be minimized. An example of such a wing is that of the World War II British fighter, the Supermarine Spitfire, shown in Fig. 11 with the beautiful elliptical-shaped wings and tail surfaces. Also on this picture is a dragonfly with its pretty tapered wings—which don't differ a great

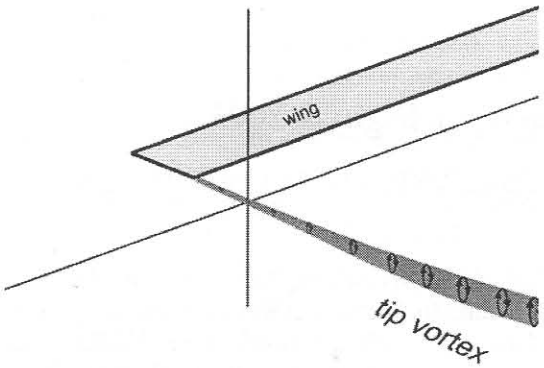


Figure 9. The wingtip vortex that results from the leakage around the wing tip combining with the incident flowfield.

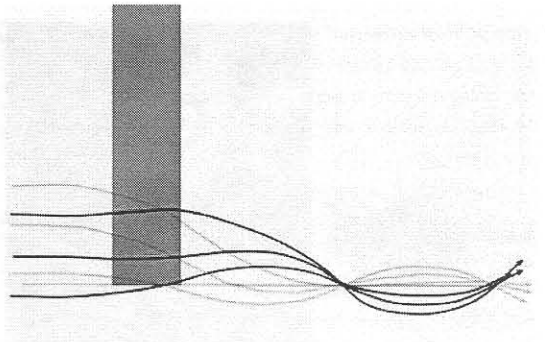


Figure 8. A representation of the combined incident flow and wing tip flow. Above the wing the flow deflects inboard, and below the wing it deflects outboard. The net result is a swirling flow that ends up forming a line vortex (sort of like a miniature tornado) that extends from the wing tip trailing edge on behind the wing.

deal from being elliptical out near the tip. Is this to make the wing more efficient or just a product of the way wing cells develop into a wing, or both?

Key facts

• Wing loading indicates the average differential pressure that must be generated by aerodynamic forces acting on the wing to support it in flight.

• The actual pressure distribution across the chord of

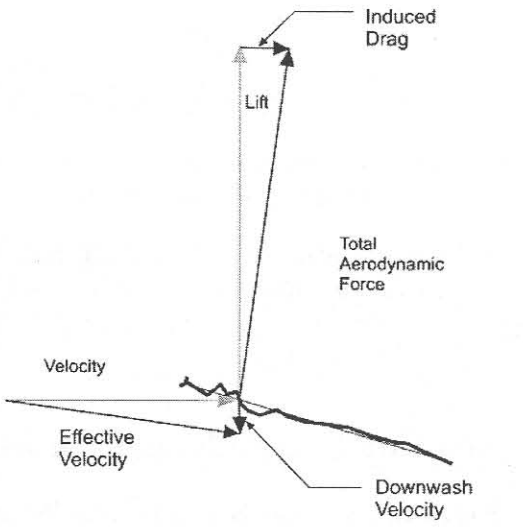


Figure 10. The vortex flow near the wing tip induces a downward flow behind the wing and near the tip called "downwash". It has the effect, when combined with the free field incident flow, of tilting the effective incident airflow vector near the wing tip downward. This means the lift vector near the wing tip is tilted backwards, giving an effective additional Drag vector. This is called the "induced" drag, and is always present when lift is generated with finite-length wings.

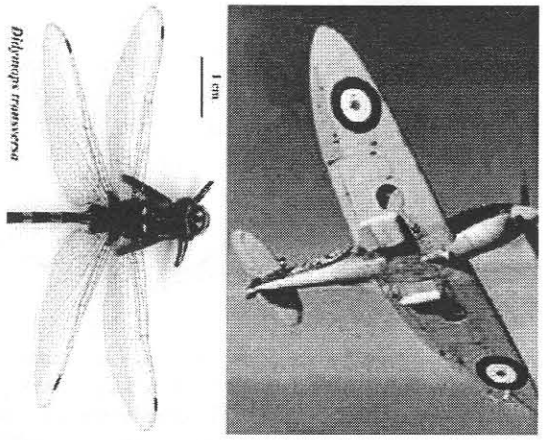


Figure 11. The shape of a wing can be optimized to produce the minimum induced drag. The shape that does this is one where the wing is elliptical in planform. Here is a famous airplane, the Supermarine Spitfire of WWII, that used elliptic wings and tail surfaces, and a dragonfly, whose wing is close to being elliptical as well.

the wing from leading to trailing edge in not uniform, but has a large peak "suction" (pressure lower than atmospheric) area near the leading edge.

• Insect wings reflect this pressure distribution in having their corrugated longitudinal veins (costa, subcosta, radius) clustered near the costal margin (leading edge).

• Wings can only generate lift if they are inclined at a leading edge up (positive) angle of attack, or if they have a positive camber (convex dorsal curvature).

• A wing with positive camber will generate more lift than a flat wing at the same angle of attack.

• Lift is the component of the total aerodynamic force that acts in a direction perpendicular to that of the velocity of the wing through the air (or the velocity of the air past the wing).

• Drag is the component of the total aerodynamic force that acts in a direction parallel to that of the velocity.

• The distribution of pressure spanwise from base to tip of the wing varies, with the net pressure difference lower near the wing tip because of "leakage" of air around the wing tip from the high pressure area beneath the wing to the low pressure area above the wing.

• This "leakage" also results in a twisting flow around the wing tip that produces a vortex from the wing tip trailing aft of the wing.

• The resulting downward flow of air behind the wing near the tip produces an effective or "induced" drag component. The wing can be shaped to minimize this drag: the resulting wing is elliptical in planform.

Next time: more on wings and vortices.

References

Links (note subtle differences):

http://www.efluids.com/efluids/gallery/trailing_vortices_2.html

http://www.efluids.com/efluids/gallery/trailing_vortices_c130.htm

http://www.efluids.com/efluids/gallery/cessnajet_1.htm

http://www.efluids.com/efluids/gallery/Trailing_vortices_1.html

New York Dragonfly and Damselfly Survey to begin in 2005

Paul Novak, New York Natural Heritage Program, NYSDEC, 625 Broadway, 5th Floor, Albany, NY 12233-4757. <pgnovak@gw.dec.state.ny.us>

The New York Natural Heritage Program (NYNHP), a partnership between the New York State Department of Environmental Conservation (NYSDEC) and The Nature Conservancy, will be receiving funding to conduct a statewide odonate inventory beginning in 2005. It is expected that the project will run through 2007 and will be similar in nature to the soon to be completed Maine Dragonfly and Damselfly Survey. Funding for the project will be provided by the U.S. Fish and Wildlife Service's State Wildlife Grants Program, through the NYSDEC to the NYNHP.

The main project objective will be to build upon the excellent county distribution data compiled by Nick

Donnelly in order to document the distribution of all odonate species occurring in New York. As of spring of 2004 the average number of species recorded per county was approximately 57, but we know there are way more than that for all counties!

Additional project objectives include: evaluating the relative abundance of ***Enallagma pictum***, ***E. recurvatum***, and ***E. minusculum*** (all state listed as Threatened species) on Long Island, and directing some survey efforts to locations identified by Tim Vogt as having some potential for the federally listed ***Somatochlora hineana.*** All three ***Enallagma*** species are currently known from fewer than ten sites on Long Island and are threatened by groundwater withdrawal, off-road vehicle use of coastal plain ponds, introduction of fish to ponds, and other factors. New York State was identified in the Hine's Emerald Recovery Plan as one of several states with dolomite regions that could support this species and Tim Vogt completed an analysis of various existing data sources, including bedrock geology and wetlands, to identify locations that may have the potential to support this species. We don't know if we will turn this species up in New York, but sure want to try!

The success of this project will depend heavily on the participation of DSA members and other odonatists here in the northeast, as well as recruiting new people to the study of these fascinating insects. It is expected that some interested project participants will be active mainly in their local areas, while others can be directed to counties that are currently under-represented with respect to species lists or to specific habitats for infrequently recorded species. Overall, on a statewide basis we expect to direct more intensive sampling to selected habitats, areas with expected high odonate diversity, and habitats of particularly rare species such as bogs, fens, seeps, and larger river habitats. We fully expect to add at least a couple of species to the New York State list (check Nick Donnelly's county dot map publications for the likely possibilities!). Lastly, it is expected that the results of the New York Dragonfly and Damselfly Survey will be presented in a variety of formats, including a high-quality book and electronic-based files for use by conservation biologists and planners at the completion of the project.

Two or more volunteer training sessions will be held in 2005 and in subsequent years and we expect that there will be one or more scheduled weekend field gatherings such as the one held on the Tug Hill in northern New York in 2002 as well.

Survey protocols and other details will be developed in the winter months in time for the project to be off and running with the emergence of early season species this coming spring! Look for additional details in the spring issue of ARGIA.

Odonate Ecology and Evolution Symposium held in Ottawa

Chris Beatty

On 17–19 September 2004, the Odonate Ecology and Evolution Symposium (OEES) was held on the Campus of Carleton University in Ottawa, Ontario. Twelve oral presentations and three posters were given in sessions on Saturday the 18th, with presenters attending from throughout Ontario, Nova Scotia and New York. Contributions were also made by researchers in Belgium and Spain. The research presented covered a wide variety of topics, including odonate behaviour, ecology, immunology, landscape ecology, mating dynamics and molecular ecology. For a full schedule of events and for presentation and poster abstracts please visit: <http://chat.carleton.ca/~cbeatty/OEES.htm>

Attendees gathered for dinner at Persian Cuisine Express in Ottawa that evening, for food, fun and discussion of all things odonate. On Sunday, 19 September, attendees of the OEES were treated to a tour of the Canadian National Collection of Odonates by Paul Catling and Raymond Hutchinson (thanks Paul and Ray!). The weekend was a great success, and the organizers would like to thank all the presenters and attendees, as well as Dr. Mark Forbes (Biology Department, Carleton University) and Dr. Jean-Guy Godin (Dean of Science, Carleton) for providing financial support for the event.

Summary of the first meeting of the Dragonfly Society of Missouri 5 December 2004

Paul M. McKenzie, Endangered Species Coordinator, U.S. Fish and Wildlife Service, 101 Park DeVille Dr.; Suite A, Columbia, MO 65203-0057

On 5 December 2004, odonatologists from across the state met in Columbia, Missouri, to discuss various odonate issues. The purposes of this initial meeting were to: 1) determine what type of database to use for tracking and updating Missouri odonate records; 2) establish what data fields to use; 3) identify priority target species, natural communities, and regions of Missouri where odonate research should be conducted; and 4) establish a name for Missouri odonatologists.

Some of the discussions followed themes presented in the last issue of ARGIA [20(3): 22–24; 33–34] by Brian Pfeiffer for Vermont and Kathy Biggs for California—excerpts from both reports were presented to participants at the meeting.

In attendance at the meeting were Dr. John Belshe (Central Missouri State University, Warrensburg), Michael Ferro (Columbia), Ron Goetz (St. Louis), Brett Landwer (Springfield, Missouri), Dr. George Shinn (Truman State University, Kirksville), Joe Smentowski (St. Louis), Linden Trial (Columbia), Tim Vogt (Missouri Department of Natural Resources—Division of State Parks, Jefferson City), Jane Walker (Washington University Tyson Research Center, St. Louis), and the author. Others not in attendance who are very much interested in future meetings and outings of our group are Dr. Roy Beckemeyer of Wichita, Kansas; Dr. Nick Donnelly of Binghamton, New York; Dr. Tim Cashatt of the Illinois State Museum, Springfield, Illinois; and Dr. Michael Engel, University of Kansas—Lawrence, Kansas. Others requesting a copy of this report are Bob Boggs, Kip Heth, and Barry Poulton.

It was unanimously decided that Microsoft Access/Excel would be the database management/spread sheet of choice. Data fields that should be included for odonate records include scientific name, date (using the three-field formula of day/month/year), sex or instar, age of individual if determinable (i.e, teneral, juvenal, or mature), number of individuals collected, collector, collector's collection number if available, county, locality data [including USGS 7.5' topographic quadrangle map name if known, township, range, section (down to ¼ section, especially for species that are being tracked by the Missouri Department of Conservation), latitude and longitude or UTM coordinates (including coordinate datum such as NAD27 or WGS84/NAD83, and what UTM Zone was used)], habitat type (e.g., fishless pond, open field, stream, large river, fen, etc.), and any additional comments.

The latter could include such information as associated plants, associated odonates, behavioral observations (e.g., ovipositing female or whether there was a pair in tandem or copula), the overall abundance of the species at a particular site, time of day, museum accession or specimen number, type of documentation (i.e., specimen or photograph, see more below), other observers or collectors present, and who made or confirmed the determination (e.g., identification confirmed by Tim Vogt; determination of ***Tetragoneuria*** or ***Sympetrum*** made by Dr. Nick Donnelly).

A large part of the afternoon session involved discussion surrounding what should be our priorities for future odonate research in Missouri. Emphasis included target species or groups, target natural communities, or areas of the state that have not been well surveyed. Target groups included select gomphids such as ***Gomphus lineatifrons***, ***G. ozarkensis***, ***G. quadricolor***, and ***G. ventricosus***; all ***Epitheca*** (***Tetragoneuria***); all ***Macromia***; all ***Stylurus*** other than ***plagiatus***; all ***Neurocordulia*** except ***molesta***, and all ***Sympetrum*** except ***ambiguum*** and ***vicinum***.

Species reported from Missouri but for which additional records are desirable (above and beyond the obvious ***Somatochlora hineana***) included ***Argia alberta***, ***Enallagma antennatum***, ***E. ebrium***, ***E. hageni***, ***Ischnura damula***, ***I. kellicotti***, ***I. ramburii***, ***Nehalennia gracilis***, ***N. irene***, ***Amphiagrion saucium***, ***Lestes forcipatus***, ***Aeshna canadensis***, ***A. multicolor***, ***Arigomphus lentulus***, ***Somatochlora filosa***, ***S. ozarkensis***, ***S. provocans***, ***Celithemis verna***, ***Dythemis fugax***, ***D. velox***, ***Leucorrhinia intacta***, ***Libellula auripennis***, and ***L. semifasciata***.

Several species were targeted that could possibly be documented in Missouri in the future. These included ***Enallagma anna***, ***Ischnura. barberi***, ***I. denticollis***, ***I. prognata***, ***Aeshna interrupta***, ***A. verticalis***,

Gomphaeschna furcillata, ***Arigomphus maxwelli***, and ***Stylurus laurae.*** Habitats or natural communities identified as needing more research included all ponds (farm ponds, fishless ponds, sinkhole ponds, beaver ponds), natural oxbows, big rivers, large lakes and reservoirs, rivers in the Ozarks, southeast Missouri swamps, natural marshes, strip mine and borrow pits, and all types of seeps (acid to saline to calcareous fens). Areas of the state determined to need the most work were streams in northern and western Missouri.

There was an interesting discussion regarding the use of photographic evidence in establishing new records. Although some (including this author) are opposed to the use of photographs in establishing county or new state records, a consensus was reached that incorporated the following suggestive criteria.

1) Tim Vogt would review photographic evidence and determine if enough information was available to make a positive identification.

2) The ultimate decision on the use of photographic evidence would fall in the hands of the person/s putting a checklist or atlas of Missouri odonates together (e.g., Linden Trial and John Belshe who are currently in the process of updating their 2002 Atlas of Missouri Odonata). It was generally agreed that our Missouri group really does not have any binding authority to attempt to dictate what final criteria someone who is gathering information for a checklist or updated atlas should use. All we can do is provide suggestions and our personal opinions.

3) When photographic evidence is to be included, a separate designation should be included in the database/atlas/checklist (i.e., record based solely on photographic evidence). This could be accomplished by putting a particular symbol on a distribution map for records based solely on photographs.

4) Records for which photographic evidence is not conclusive should not be included in the scheduled update to the Missouri Atlas. This could be due to a lack of clarity of a photo, the angle the subject was photographed, shadow problems, or involve species for which positive identification can never be confirmed without examining the specimen in hand or under a microscope/dissecting scope. Examples include ***Enallagma ebrium*** vs. ***E. hageni***, ***Lestes australis*** vs. ***L. forcipatus***, or ***Tetragoneuria***. One suggestion was that an a priori list be made of species for which photographic records would be accepted. New county and state records would be provisional, based upon subsequent collection of a specimen. It was recognized that photographs can greatly aid in directing surveys to sites where species previously had been undocumented.

5) Some attendees requested that discussions on this issue continue.

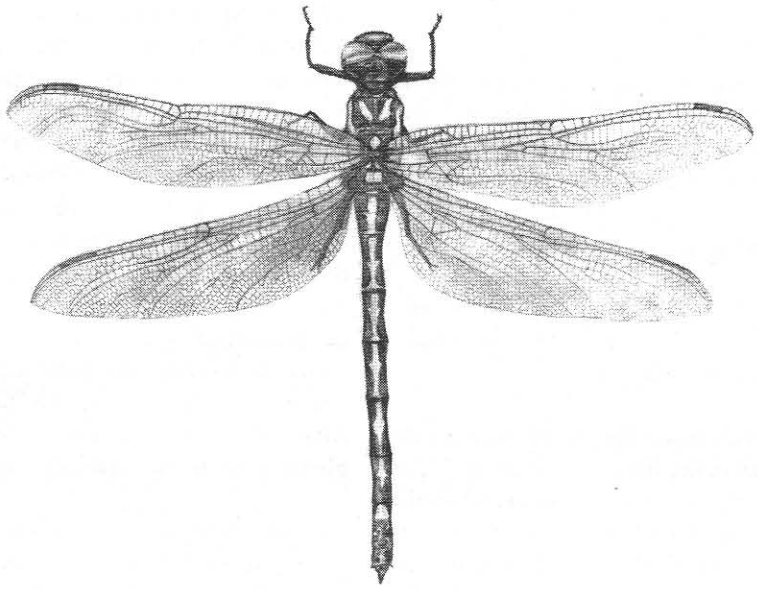
The final discussion of the day centered on exactly what we should call our group. Suggested names included the Missouri Odonatological Society, the Missouri Odonata Society, and the Missouri Odonata Survey. Although these would all be appropriately abbreviated as the acronym MOS, odonatologists in Michigan already use that abbreviation in identifying folks in that state who study odonates. Other names suggested were the Dragonfly Society of Missouri, the Missouri Dragonfly Society, and even a tongue in cheek "MOD Squad"—a short form of the Missouri ODonatolgical Society where squad is substituted for society. Following subsequent input, the largest number of votes was cast for the "Dragonfly Society of Missouri" or DSM for short. Mike Ferro took a group photo of our newly established group.

The last point of business was an agreement that the group should meet in Kirksville around 11–12 June 2005 to jointly conduct a survey for odonates in northern Missouri. Teams would split up and collect in an approximate six county region that would include such areas as Goose Pond and Mussel Fork Conservation Area. Other areas will be identified as we get closer to the date. Dr. Shinn will be the local contact for the north Missouri survey. We would like to offer a cordial invitation to members of DSA who might want to join us during this weekend event. If you would like to attend, please contact Tim Vogt (somatochlora_sp1@yahoo.com), George Shinn (gshinn@truman.edu), or me (paul_mckenzie@fws.gov) via e-mail. There is a relatively new Super 8 in Kirksville that would be well suited for our weekend foray.

Based on subsequent e-mails sent by participants and comments made during our meeting, our initial gathering of 5 December was deemed to be an overwhelming success. All participants looked forward to additional meetings and to joint collecting trips in the field in the future.

Dragonfly Drawing from one of our Favorite Places

Little did we know that Grantsburg, Wisconsin, site of the second annual meeting of the DSA in 1991, would produce more than the snaketails ***Ophiogomphus howei*** and ***susbehcha*** (for which many of us have warm memories of this beautiful place). A young lady, Kerissa Nelson, in town has developed a fondness for dragonflies and has produced the accompanying sketch of a female ***Cordulegaster obliqua***, one of the most beautiful spiketails. She is now said to be looking for further opportunities in illustration. Any ideas?



Evening Shopping

(from an e-mail)

Hi Folks: Saturday evening (8:30 PM) I walked into a Convenience store in Davis, California, to grab a bag of Fritos and a Coke. As I walked in, a Pacific Forktail (***Ischnura cervula***) flew over my shoulder, made a right turn and flew slowly down the aisle. We both arrived at the Frito display about the same time. He landed on the metal display rack about six inches from me. After checking out the Fritos, he took off and went down another aisle. He didn't seem concerned about people in the store or anything else. I don't know if he scored any chips or not.

What was interesting to me was: 1) it was dark outside (one hour after sunset), when most odes aren't out hunting much, but it was hunting in an area with bright artificial lights with lots of nocturnal bugs around; 2) it was hunting inside a store. Was this accidental or just part of its territory.

Cheers, Ed Whisler, Davis, California

Book notice: Damselflies of North America. Revised Edition—2005, by M.J. Westfall, Jr. and M.J. May (Revised by M.J. May).

The original text from 1996 is revised, with new distribution data, corrected keys, and the addition of two Mexican species newly recorded for the region, plus added figures for these species. The page format is altered to conserve space better, thus saving over 100 pages of text and keeping the book cost down, but the size of the pages remains the same at 7 × 10 inches.

Newly added is a supplemental volume of color plates illustrating all 163 damselfly species for North America with photos taken in nature. This second part to the new edition will contain about 60 color plates. Part 2 will be sold separately for those wanting to add it to their copy of the first text edition, while a discount price package will be available for those purchasing the entire two-volume set of the new edition.

The projected date of publication is June 2005.

Publisher's projected prices include postage and handling. Note the reduced prices for advance orders.

Part 1: Text approx. 550 pp. $85.00 in the U.S.; $100.00 outside the U.S.; advance order price $80 in the U.S.; $95.00 outside the U.S.

Part 2: Atlas approx. 60 color plates of 163 species. $65.00 in the U.S.; $90.00 outside the U.S.; advance order price $62.00 in the U.S.; $85.00 outside the U.S.

Revised edition set: Part 1 and Part 2. $125.00 in the U.S.; $137.00 outside the U.S.; advance order price $115.00 in the U.S.; $132.00 outside the U.S.

Send check made payable to IORI, % Bill Mauffray, 4525 NW 53rd Lane, Gainesville FL 32653

For additional information and/or to pay by credit card use PAYPAL at the web site <http:// www.afn.org/~iori>. Follow the instructions from the web site.

Book notice: Tillyard's 1917 masterpiece now available after an absence of many years

A letter from Richard Hildreth brought the very welcome news that Tillyard's "The Biology Of Dragonflies" (Cambridge Univ. Press, 1917) is now available again, many years after having gone out of print. I bought my copy in 1949, when it was still in print, and it was the second dragonfly book I owned (the first being Garman's "Odonata of Connecticut"). My own copy is well worn, and it is still one of the first books I take off off my laden shelves when someone poses a novel problem to me. The price for the paperback edition is $17.95, which makes it one of the major book bargains in the dragonfly world (Only that Stokes guide by Nikula *et al.* gives you more for your money.). I haven't done the math, but I am certain that, in terms of 1949 dollars, this book is far cheaper than my in-print copy.

So, run, do not walk, to your computer and tap out <www.elibron.com> to order your copy.

Papers Notice: some recently published papers

Gibbs, K.E., B. Bradeeen, & D Boland. 2004. Spatial and temporal segregation among six species of coexisting *Ophiogomphus* (Odonata: Gomphidae) in the Aroostook River, Maine. Northeastern Naturalist 11(3): 295–312

Tennessen, K.J. & T.E. Vogt. 2004. *Ophiogomphus smithi* n. sp., (Odonata: Gomphidae) from Wisconsin and Iowa. Proceedings of the Entomological Society of Washington 106(3): 540–546

Tennessen, K.J. 2004. *Cordulegaster talaria* n. sp. (Odonata: Cordulegastridae) from west-central Arkansas. Proceedings of the Entomological Society of Washington 106(4): 830–839

TRAMEA

The University of Kansas Natural History Museum Web Page on "Scientific Illustration Using A Computer"

Roy Beckemeyer

University of Kansas NHM illustrator Darci Kampschroeder has put together a marvelous tutorial and primer on computer-based scientific illustration. It can be found at <http://nhm.ku.edu/illustration/>.

Based primarily on the use of the widely available Adobe Photoshop <http://www.adobe.com/products /photoshop/main.html> and Adobe Illustrator <http://www.adobe.com/products/illustrator/main.html> software packages, the techniques are really more general in application, and can pretty readily be adapted to other software tools. For example, although I use Photoshop, I don't have access to Illustrator. Instead I use what I feel is an equally powerful (but much lower cost) vector graphics software package called Xara X1 <http://www.xara.com/products/xarax/>. But Darci's methods and hints have worked with this software quite well (of course, the specific tools and implementation are different).

Darci covers three major types of illustration that she does for the museum: Habitus Drawings, Photo Illustration, and Structural Drawings. Her tutorials use actual illustrations and are well constructed and very clear. I was interested to learn that she feels that manual techniques she describes for making photo montages in which every part of an insect photographed through a microscope is in focus produce more reliable and consistent results than the high dollar software/hardware packages that automate the process <http://nhm.ku. edu/illustration/photoillustration/compositing.html>.

The lessons deal with illustrations from insect specimens, but I have found the methodology to be quite useful in producing wing venation drawings from fossil wing specimens as well. I have described several new species of fossil insects the past couple of years, and the wing venation drawings were always very time consuming and troublesome. Since coming across Darci's web site, I have completely revised my approach, and am quite pleased with the improved accuracy and quality of the drawings I have produced by adapting her techniques.

I highly recommend this web site to the DSA members who do scientific illustration (or field guide illustrations). I also should note that I do not have ties to any of the software companies mentioned above.

Ohio Data Available Online

Robert C. Glotzhober, Ohio Historical Society

Information about dragonfly and damselfly specimens from Ohio can currently be found online via two different sources.

Dave McShaffrey of Marietta College maintains a web site for the Ohio Odonata Society at: <http://www.marietta.edu/~odonata/index.html>. These pages are a few years behind our most current data, but provide maps of the state for each species known from Ohio. They are similar to those found in Dragonflies and Damselflies of Ohio, 2002, published by the Ohio Biological Survey. You can also get the pages to produce a list for any county in the state—very handy if you are planning a trip to an area of Ohio that is new to you and want to see what you might expect to find or what to watch out for if you want to record a new county record.

The Ohio Historical Society web site (http://www.ohiohistory.org) also has an online catalog feature. Go to the web site and progress to the catalog one of two ways. In most browsers there is a link at the very top of the page that says in small type "Go to the Online Collections Catalog". If your browser does not show that, then select the item in the bar menu that says "Resources" and go to "Online Research Tools"

then item 5 "Online Collections Catalog." Once at the catalog page, select "Museum Collections." Next you can precede a number of ways, depending upon what you want. If in your search you select "Natural History Subjects" and type in "Odonata" you can pull up all 4651 records of Odonata in the cataloged collections of the Ohio Historical Society. It is not the easiest to use, but they can be sorted in a number of ways or browsed. If you have a specific species you want to check out, do a search on "Object Name" and type in either the scientific name or common name of the species you want. This will give you all objects listed under that name in our collection.

Of course, you can always contact me directly (e-mail: bglotzhober@ohiohistory.org; phone: 614-297-2633; or by mail at: Ohio Historical Society, 1982 Velma Avenue, Columbus, Ohio 43211-2497) and request more detailed or up to date info. My available time with recent staffing cutbacks is limited, so I may not be able to respond to a casual request, but am willing to assist anyone with a serious survey or research question. The Ohio Odonata Society database now contains more than 27,000 records from many institutions in a Microsoft Access database. I can within reasonable time and within reasonable restraints provide either printouts or CDs of information that may be needed. I will probably need to discuss with each requestor the level of information they need, the format they desire, and (for commercial use or high depth of detail) possible charges for supplies and time.

IORI web site enhancements

Bill Mauffray, International Odonata Research Institute, Gainesville FL, <iori@afn.org>

The IORI web site <www.afn.org/~iori>, is one of the oldest dragonfly web sites. It was established in 1994 as a public service by Bill Mauffray to provide a one-stop source of information about Odonata. Some of the features include the International Directory of Odonatists, the listing of faunal lists, and information about meetings and events, as well as, information about recent publications and where to purchase them.

Following the publication of the damselfly manual of Westfall & May (1996), a web page featuring the Zygoptera of North America was set up and included all of the state records listed in that publication. Requests were made to provide data to add or remove state records since then. Each change made to the list was accompanied by a link to the reference that warranted the change.

In 1997, a similar list was created based on all published data to that date. The results of the interactive list were used in Needham, Westfall, and May (2000). Additions and deletions have been maintained on both lists since then.

Two new features have been added to both lists over the last several months. Common names based on the DSA approved list, and links to web images. Both of these features allows the user a one stop location for the state records, scientific and common names, and images which include both photos and some range maps.

Request is made again for readers to view the sites and offer corrections along with supporting data. Records from articles included in ARGIA have, for the most part, been included already.

The Zygoptera data will be incorporated into the 2nd edition of the Damselflies of North America, which will go to press sometimes in the late spring of 2005.

References

Mauffray, W.F. 1997–2004. The Odonata Information Network. www.afn.org/~iori/

Needham, J.G., M.J. Westfall and M. L. May. 2000. Dragonflies of North America. Scientific Publishers, Gainesville Florida, xv + 939 pp.

Westfall, M.J. and M.L. May. 1996. Damselflies of North America. Scientific Publishers, Gainesville Florida, vi + 650 pp.

Back Issues of ARGIA and the Bulletin of American Odonatology

The editor is able to provide back issues of ARGIA. The present price schedule takes into account the different costs of duplication of each number of ARGIA. In the event that an issue becomes exhausted, then photocopies will be sent. Prices $3.00 per issue; this does not include postage; see below.

Back issues of the Bulletin of America Odonatology can be furnished at the prices given below. Prices do not include postage; see below. For several issues, consult the editor for postage.

Please contact T. Donnelly, 2091 Partridge Lane, Binghamton NY 13903

1(1) The Odonata of New York, Thomas W. Donnelly, p. 1–28 $3.00

1(2) Distribution of Dragonflies and Damselflies in Florida, Sidney W. Dunkle, p. 29–50 $2.50

1(3) Morphological and ecological differences among species of *Ladona*, Michael L. May, p. 51–56; Comportamiento reproductivo y policromatismo en *Ischnura denticollis* Burmeister, Alejandro Córdoba Aguilar [with English summary], p. 57–64 $1.50

1(4) A checklist of the Odonata of the Dominican Republic by Province, Jerrell James Daigle, p. 65–69; Odonata de la Sierra de Huauchinango, Puebla, Mexico [with English summary], José A. Gómez Anaya and Rodolfo Novelo Gutiérrez, p. 71–73 $1.50

2(1) La Nayade de Archilestes latialatus Donnelly, 1981 [with English summary], R. Novelo-Gutiérrez, p. 1–7; Descripción e Historia Natural de las Larvas de Odonatos de Costa Rica. III *Gynacantha tibiata* (Karsch 1891) [with English summary], Alonso Ramírez, p. 9–14 $1.50

2(2) Description of the Nymph of *Epitheca* (*Tetragoneuria*) *spinosa* (Hagen), K. J. Tennessen, p. 15-19; The Larva and Adult Male of *Somatochlora georgiana* Walker, Jerrell J. Daigle, p. 21–26 $1.50

2(3) *Macromia illinoiensis* and *georgina*: a Study of heir Variation and Apparent Subspecific Relationship, T.W. Donnelly, K.J. Tennessen, p. 27–61 $3.00

2(4) The Subgenus *Tetragoneuria (Anisoptera: Corduliidae: Epitheca)* in New Jersey, Michael L. May, p. 63–74 $1.50

3(1) The Odonata of Ohio—a Preliminary Report, Robert C. Glotzhober, p. 1–30 $3.00

3(2) Four Decades of Stability and Change in the Odonata Population at Ten Acre Pond in Central Pennsylvania, Clark N. Shiffer & Harold B. White, p. 31–40; Descripción e Historia Natural de las Larvas de Odonatos de Costa Rica. IV. *Mecistogaster ornata* (Rambur, 1842) [with English summary], Alonso Ramírez, p. 43–47 $1.50

3(3) The Distribution of Odonata in Alabama, Kenneth J. Tennessen, James D. Harper, R. Stephen Krotzer, p. 49–74 $3.00

3(4) Distribution Records of the Odonata of Montana, Kelly B. Miller and Daniel L. Gustafson, p. 75–88 $1.50

4(1) An Annotated List of the Odonata of New Jersey, With an Appendix on Nomenclature in the Genus *Gomphus,* Michael L. May & Frank L. Carle, p. 1–35 $3.00

4(2) The Odonata of Patuxtent Wildlife Research Center and Vicinity, Richard L. Orr, p. 37–67 $3.00

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