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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** are best transmitted as attachments to e-mails, but can be submitted on floppy disks. The editor prefers MS DOS based files, preferably written in Word, Word for Windows, WordPerfect, or WordStar. **All files should be submitted unformatted and without paragraph indents.** 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 as e-mail attachments or on floppy disk, 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 North Americans and \$25 US for non-North Americans and institutions.

Front cover: *Cordulegaster sayi*, by Giff Beaton. Truly one of the joys of southern springtime!

In This Issue

We thought last year was bad, but this spring was worse! Tom and Ray, of the popular radio show, Car Talk, summed it up by reminding us that "April showers bring May showers . . ." They didn't add, "and cold".

The Executive Committee takes great pleasure in electing Carl Cook to Honorary Membership in the society. All of us have taken great pleasure in being in the field with Carl and marveling at his keen observations and stimulating suggestions on all sorts of dragonfly questions—but mainly his beloved gomphids.

We sadly report the death of Bud Gode, who is best known for his participation in the thorough study of Iowa odonates that was published a few years ago in the BAO. Bud was a thoroughly pleasant person and will be missed by a great many odonatists.

Bob Dubois and co-workers report on the activities and finds during last year of many notable odes in Wisconsin. This is yet another state whose potential is starting to be realized by our community of workers.

Roy provides the fourth installment in his series on dragonfly (and damselfly) flight. It seems that these tiny creatures take full advantage of phenomena that slow down much larger airplanes.

Fred Sibley contributes two articles showing what we in the north missed by staying at home and freezing last winter. Jerrell Daigle adds to this with more fun in the sun.

John Matthews outlines his dissertation project on *Anax junius*, otherwise known as the great migrator. John also asks for our assistance with observations on this curious beast.

François Meurgey adds yet another record for the still-little-known Lesser Antilles. Paul Brunelle gives us some native art from the Mi'kmaq Indians of the Maritime provinces. It seems that these inventive people really like dragonflies! Roy Beckemeyer finds a jazz musician who has devised a riff on—what else—the song "Aka Tombo".

We include four abstracts of talks to be given at the Ottawa meeting. This proved a very worthwhile activity last year, and we hope the practice grows.

We review two major books this time: John Abbott's eagerly awaited guide to dragonflies and damselflies of Texas and the south central states, and the second of Warwick and Michèle Tarboton's magnificent guides to South Africa—this one on damselflies.

Finally, Linden Trial has published the second edition of the Atlas of Missouri Odonates. What a magnificent job she and her co-workers have done out there!

Colin Jones announces the launching of a major web site devoted to Ontario Odonata.

It has been a quarter full of accomplishment. Now let the summer enter and the real fun begin! 

Nomination of Carl Cook as Honorary Member of the Dragonfly Society of the Americas

Carl Cook is one of the senior members of our society and is certainly a person with a very long, unbroken record for dragonfly study in the United States. He begins his own account of early dragonfly study in 1940 (Cook 1994), when he had captured an *Ophiogomphus aspersus*—a fine record for Kentucky of a species then not known from south of New England. He had been previously inspired by the late Harrison Garman, Kentucky's first odonatist (not to be confused with Philip Garman, of Illinois and Connecticut fame). Carl more or less stayed put for many decades, and still lives only a short distance from his childhood home

and still collects along the Little Barren River, where he has documented gomphids and other dragonflies for more than a half century. Many visiting odonatists have been taken by Carl to collect on the river where it traversed family property and were able to experience one of America's premier gomphid streams in the company of one of America's premier gomphid specialists. It is doubtful that there has been any North American that has observed this dragonfly group so closely and for such a length of time as has Carl.

His studies have resulted in the description (With Jerrell

Daigle) of the distinctive Ozarkian *Ophiogomphus westfalli*. Recently, working with Ellis Lauder milk, he settled a long-puzzling problem by describing a second North America *Stylogomphus*, which he named *sigmastylus*. Carl also has described several Neotropical dragonflies, *Phyllogomphoides apiculatus* (with Enrique Gonzalez), the male of *Phyllogomphoides inperator*, and the aeshnid species *Castoraeschna decurvata* (with Sid Dunkle).

Carl has also been known for his painstaking studies of *Macromia*, a genus that continues to baffle North American odonatists after more than a century.

Carl was one of the founders of the DSA, and served as its first president. He also created ARGIA and edited it through volume 4, number 1, when illness forced him to relinquish his editorial duties. By this time he had created one of the truly fine Odonata newsletters in the world.

For Carl's contributions to the knowledge of North American dragonflies, for his generous assistance to oth-



ers involved in these problems, to his hosting of visitors at his famous Little Barren River, for his major participation in the founding of our society, and for his creation of its newsletter ARGIA, we are pleased to nominate Carl Cook as an honorary member of our society.

Partial bibliography of Carl Cook

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Calendar of Events for 2005

Event	Date	Location	Contact
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
WDA Symposium	26–30 July	Vigo, Spain	http://webs.uvigo.es/c04/webc04/WDA/index.htm

Orrin “Bud” Gode: 10 Oct. 1924–1 May 2005

Bob Cruden

The day Bud turned 80 he hiked ten miles in Madera Canyon his favorite haunt following his move from Iowa to Arizona. This was the Bud that worked with me on our survey of Iowa's Odonata. He rarely tired and was almost always positive, even when I missed a big one. Our drives across the state were memorable from the TVs (Turkey Vultures) soaring above, comments about the silent ones (residents of a cemetery), or that's a real fixer-upper (about a barn ready to fall down). Once, I called him in mid-morning and wondered if he'd like to go out in the field for the rest of the day. He said sure. We were well up the road before he asked if I had heard the weather forecast for the afternoon. Of course I hadn't, and the sky was virtually cloudless. So he passed on the information that there would be rain and thunder storms starting in early afternoon and continue the rest of the day. Even so, he thought it would be profitable if we got in a few hours of collecting. Most of us having heard the forecast would have found something else to do. The storms arrived the next day. Over the years we learned to take weather forecasts with the proverbial grain of salt. If he was tired toward the end of the day he would become the sit-and-wait predator. It always worked. He would see something that I had not seen, even though I had walked half a mile up and back down the creek. In addition, he took a certain amount of glee in reporting on some neat bird he'd seen.

Collecting with Bud was exciting. We encountered a swarm of feeding *Aeshna* in the Yellow River State Forest in northeast Iowa. Before I could put the handle of my net together he was off to the chase. Shortly thereafter he was coming straight at me, the net cocked behind his head, he swung on the dead run, straight overhead, and the net landed at my feet. The critter was *Aeshna tuberculifera*, and it was the only time we collected the species. He thought that was a good way to start the day. Our first encounter with *Ophiogomphus rupinsulensis* was on a river in northeast Iowa. He walked down to the river and walked upstream, and before I had crossed the river he had a female in his net. On another occasion it was quite late in the day, and we stopped at a broad, sandy bottomed river

in Bremer County. We watched the river, and eventually a gomphid darted across the river and back and landed in a tree or bush 50 or so feet down stream. After waiting five minutes or so Bud took things into his own hands and walked down to where he thought the critter had gone and beat on everything within reach. He was rewarded, it flew a considerable distance up stream below a bridge and then it suddenly turned and flew downstream straight at me. It was our only collection of *Stylurus spiniceps*.

His knowledge and love of Iowa was a product of the many years he served as county engineer in Johnson County (Iowa City) and elsewhere in Iowa. His knowledge of how things worked made our travel around the state much easier. Very early in our travels we came to “road closed” signs and I slowed the car to follow the detour sign. “Keep going” he said, so I kept going, with, I might add, a certain amount of trepidation, expecting to run into heavy equipment over the next hill. The road was all done but painting the center line and edges of the road. Bud knew these things.

During the unpleasantness of the 1940s Bud was a Second Lieutenant, a navigator of B-17s, and flew 35 missions over Europe. He earned the ETO ribbon plus two stars and the Air Medal with numbers of clusters. He never talked about this. Following the war he married Mary Catherine Cooney in April of 1945 and soon thereafter he became an engineering student at the University of Iowa and graduated in 1949. The couple had three sons and a daughter and eventually a number of grandchildren whom he loved. He observed on several occasions that he and Mary visited the kids, rarely vice versa, because when he got tired of the grand kids he could return to the motel.

Wherever he lived he was involved with education. He returned so much to the community. In Iowa City he volunteered at the local raptor center. He did whatever had to be done, from cleaning cages to teaching kids of all ages about birds. Hundreds of kids that visited the Natural History Museum at the University of Iowa have an arrowhead that was carefully crafted by Bud. He guided

hundreds of kids through the museums exhibits. At Iowa Lakeside Laboratory he taught students how to paint window sills, the old fashioned way. I suspect they learned a lot more than that. More recently he was involved with educational programs at Madera Canyon where he gave guided bird tours to 4th graders. His birding friends up north regularly received a new lifer memo. For the past few years he had been watching a trogon nest. He was gathering data on the behavior of the nesting birds. On one occasion he was sitting near the nest tree and some "tickers" came up the trail and asked if there were trogons in the vicinity. He said yes there were. They asked how far they had to go to see one. He said, right here. They waited, and waited. Finally, when will they be back? In about 4 hours. The tickers went back down the trail.

In 1989, plus or minus a year or so, an obviously older chap was sitting in the front row of my Plant Ecology class. It did not take too many class meetings to realize that he was a really good student. At some point he came to me and wondered if he knew enough to take courses at Iowa Lakeside Laboratory. Over the course of several summers he took a number of courses at the lab. He loved it. In 1993 a former student of mine wanted a project that she could do at the lab. I suggested a survey of the Odonata of Dickinson Co. Some weeks later Bud decided he would like to spend the summer at the lab. The two joined forces. The appropriate keys were available and they spent every evening side by side at a lab bench with microscopes in front of them and the days catch within reach. They argued, laughed, and taught each other. I had to listen to these exchanges, which on occasion got a little heated. What a way to learn. By the

end of the summer they could identify with ease most of the 60+ species that occur in that part of the state. The following summer the project expanded to cover the 16 counties of northwestern Iowa and the following year to cover the entire state. The traits that made Bud an excellent birder were the same ones that made him an excellent odonater.

Another story about Bud comes from a trip that he took with the ornithology class at Iowa Lakeside Laboratory. According to the professor: "We were canoeing the Bois Brule River in northern Wisconsin and about to go down our first rapids, Wildcat Rapids. So, I got out with the class, and pointed out how to navigate the rapids. I went down first with a student in the bow and a terrified Chinese student in the middle. No problems. The second canoe came down with no problem. Third canoe, no problem. I had asked Bud to come down last to mop up, so to speak. So, we're sitting waiting, but no Bud. He was with a particularly attractive young lady who spent her spare time modeling for Victoria's Secret, but we didn't think that was the problem. Finally, here comes a canoe—backwards. Bud, now in the new bow, is paddling over his shoulder trying to dodge rocks, and the student has jumped around in her seat to assume the stern duties. They got through without a problem. As Bud canoed up, he said, "Anyone can do it forwards."

Bud was born in Marengo, Iowa, a few miles west of Iowa City. In 1998, he and Mary moved to Green Valley, Arizona. He was diagnosed with lung cancer late in 2004 and joined the silent ones 1 May 2005. He is sorely missed.



Wisconsin Odonata Highlights in 2004

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A number of Odonata-related projects are being carried out by a small band of professional and non-professional odonatologists in Wisconsin. Like many states, Wisconsin now has a statewide Odonata atlas project called the Wisconsin Odonata Survey (WOS). WOS is organized by endangered resources professionals from the Wisconsin Department of Natural Resources (WDNR) and relies largely on citizen volunteers to improve knowledge of distributions and habitats for our 160+ species. WOS now has a web site <<http://atriweb.info/inventory/Odonata/>> that

provides ecological and distribution information about our species, and informs about how interested non-professionals can become involved with the survey. Also, an annotated checklist to Wisconsin Anisoptera can be found at <<http://www.entomology.wisc.edu/wes/pubs.html>>.

Other projects include an extensive peatlands initiative to shed light on distributions and status of a number of rare darners and emeralds, and an ongoing large rivers initiative using exuviae collections to better understand rare

gomphid distributions in those habitats. This spring will see a major study along the entire length of the St. Croix River on the Wisconsin/Minnesota border. The St. Croix is a rare system in the Midwest in that it is fairly large yet relatively undisturbed, with extensive nearly pristine sections. Large sections of the riparian zone are under National Park Service protection. These projects rely heavily on data collected by interested non-professionals. Anyone desiring to become involved in these projects can contact BD or BS, or visit our web site for more information. Further, we have a number of ongoing taxonomic rearing projects aimed at improving regional keys to larvae of *Leucorrhinia*, *Somatoclora*, *Williamsonia*, *Boyeria*, *Ophiogomphus*, several *Gomphus* subgenera, and other problematic groups. Brief descriptions of the peatlands initiative and noteworthy species records in 2004 follow.

Peatlands Initiative: The goal of this project is to collect baseline data on the distribution of rare vascular plants and invertebrates (including odonates), small mammals, birds, reptiles, and amphibians in peatland natural communities in Wisconsin. The intent is that we can assess the impacts of global climate change in Wisconsin by conducting baseline inventories in a set of natural communities (peatlands) that are most likely to be affected. Intensive surveys are being used to identify relationships between various species and a suite of environmental variables. Extensive surveys will determine if observed relationships are consistent among Ecological Landscapes across the state. The results will serve as a baseline to compare with future surveys and identify potential changes in species distributions, abundance, and phenology resulting from climate change. Our efforts to date have focused on identifying, categorizing, and selecting study sites suitable for these analyses, and some preliminary data collection. Last summer efforts were especially directed at coastal peatlands adjacent to Lake Superior (final report available from BD).

Peatlands dragonflies and damselflies were sampled by searching suitable microhabitats for evidence of breeding (ovipositing adults, larvae in the water, and exuviae on emergent vegetation). Adults were netted and released unless specimens were needed for species determinations. Larvae were collected with dip nets using a modified kick-net process, and were usually retained for species identification in the lab. Some were reared to verify determinations. In 2004, we made 426 sampling visits to 183 peatland sites that resulted in 199 new county records of odonates, and two new state records for Wisconsin. This work has resulted in changes in tracking status of seven odonate species on the Natural Heritage Inventory Working List used by the WDNR's Bureau of Endangered Resources. Additional sampling of peatland habitats throughout the state is scheduled through 2007.

Species targeted by the peatland initiative, with the number of new county records established in 2004 in parentheses, were *Aeshna verticalis* (2), *A. tuberculifera* (2), *A. sitchensis* (1), *Nannothemis bella* (1), *Somatoclora forcipata* (1 for Barron County which is now the southernmost record for this species in Wisconsin), *S. franklini* (2), *S. incurvata* (2), *S. kennedyi* (2), *Sympetrum danae* (1), *Williamsonia fletcheri* (5), *W. lintneri* (1), *Coenagrion interrogatum* (1), and *Nehalennia gracilis* (1). The more noteworthy of these records, and other noteworthy records from WOS in 2004 are described below.

Noteworthy Species Records: In 2004 we documented two first state record (FSR) species in several northern counties. Additional records for several other rare species were documented, fleshing out their known distributions in the state. A fuller description of the habitats of the FSR species is currently available from BD in the coastal peatlands final report alluded to earlier, and will be available in an article now in preparation for publication in The Great Lakes Entomologist.

Aeshna sitchensis FSR — Although known from Minnesota and the Upper Peninsula of Michigan, this boreal species had not previously been found in Wisconsin (Smith *et al.* 2003, Donnelly 2004b). While surveying coastal peatlands for odonates during the summer of 2004 we located a breeding population in a poor fen on Stockton Island, Ashland County, within the Apostle Islands National Lakeshore (AINL). Adults and exuviae were collected. A single adult male was additionally collected off a "sidewalk habitat" in downtown Superior, Douglas County, in October 2004.

Enallagma clausum FSR — Although this western species had been reported from a number of central Wisconsin counties (Donnelly 2004a), all previous records were larval and we were unable to confirm that any of them were indeed this species. In July 2004, we found a mature pair along a Lake Superior beach near the mouth of the Sand River, Bayfield County, also within the AINL. Several adults and a newly emerged teneral were also collected along the shoreline of Allouez Bay (connected to Lake Superior) near the City of Superior in Douglas County. Although the precise breeding site was not found at either location, the presence of a newly emerged teneral indicated that this species did breed in Wisconsin in 2004.

Somatoclora cingulata — This species was previously known from just one site in the Northern Highlands-American Legion State Forest in Vilas County. While surveying a site for the peatlands project, Wayne Steffens collected an adult male on 12 August 2004 flying over an open fen in Forest County near Franklin Lake in the Chequamegon-Nicolet National Forest.

Somatochlora incurvata — This state-endangered emerald has a northeastern distribution, and is at the western edge of its range in Wisconsin (Donnelly 2004c). Most previous Wisconsin records were from a handful of sedge-dominated poor fen habitats in several central counties in the bed of former Glacial Lake Wisconsin. In 2004, we discovered a robust population co-existing with *A. sitchensis* at the Stockton Island poor fen. This site lies at the northwestern tip of the species range. A final report describing the habitat in detail is available from BD. Also, a paper describing the larva of *S. incurvata* is planned for submission to *Odonatologica* by mid-April.

Williamsonia — Several more sites were discovered for *Williamsonia fletcheri* and a few new sites were found for *W. lintneri*. *W. lintneri* is still limited in its known range in the bed of former Glacial Lake Wisconsin, while *W. fletcheri* appears to be distributed throughout the northern and central part of the state.

Coenagrion interrogatum — This species may be Wisconsin's rarest damselfly. It was previously known from just three sites in Vilas County during the 1960s. In 2004, a mature male and female were found at a bog-rimmed pond in Oneida County.

Nehalennia gracilis — Another rare damselfly in Wisconsin, this species was known from just a few scattered bogs. In 2004, a strong population was found around

the periphery of the same bog-rimmed pond in Oneida County that held *C. interrogatum*.

Enallagma aspersum — Known sites in the state for this uncommon species were doubled, from three to six, in 2004. Most sites were clear, shallow ponds with an alkaline pH.

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

Roy Beckemeyer

Part 4. Wings and Vortices.

In the last installment we learned that, near the tips of wings, the high pressure below the wing coupled with the low pressure above the wing and the flow past the wing combine to produce a “tip vortex”. This vortex extends, like a miniature tornado, from the wing tip back into the flow behind the wing.

But tip vortices are just one manifestation of vorticity and its fundamental role in the generation of lift. Let's look at the wing in cross section once again. Figure 1 shows a simple flat wing cross section gliding through the air at an angle of attack. The gray lines are streamlines. You may recall from part two of this series that the speed of the air past the wing is highest and the pressure is lowest where the streamlines are closest together. Similarly, the speed is lowest and the pressure highest where the streamlines are furthest apart. Figure 2 illustrates the pressure distribu-

tions over the upper and lower wing surfaces due to the flow of Figure 1.

It is interesting to note that, if we were to use the theory of incompressible, frictionless fluid flow to try to model the air flowing past a flat plate wing, as early scientists did, we would not get the result shown in Figures 1 and 2, but a result like that in Figure 3a. The streamlines above and below the wing are symmetrical in such a way that there is no lift produced at all, although there would be a turning moment or torque that would spin the wing in a clockwise direction (Fig. 4).

One of the first aerodynamicists, F.W. Lanchester, in his classic book “Aerodynamics” (1907), realized that to get the flow shown in Figure 1 it was just necessary to superimpose the flow of Figure 3a with a circulating flow that went around the wing section in a clockwise direction (Fig. 3b). If the strength of the circulating flow (called, appro-

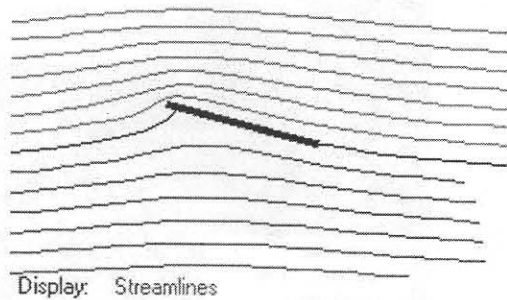


Figure 1.

priately enough, the "circulation") is chosen correctly, the net flow at the trailing edge of the wing section is smooth, with the velocities above and below the wing identical at the trailing edge (as in Figures 1 & 3c).

By using a more elaborate theoretical model that accounts for viscosity of the air, and letting the viscosity become vanishingly small, it can be shown that the resulting flow is exactly that we get by adding circulation to the wing when using the model that neglects viscosity. The requirement that air must flow smoothly from the trailing edge of the wing (called the "Kutta-Joukowski" condition, after two early applied mathematicians who helped to develop the math models for predicting the lift of wings) is thus a means of accounting for the physical effects of viscosity while using a non-viscous math model.

What happens physically to cause this circulatory flow around the wing? A very famous (in engineering circles) fluid flow researcher from, Germany, Ludwig Prandtl, made a series of photographic images in the early part of the 20th century that were later published in the book "Applied Hydro- and Aeromechanics" (there is a Dover Press reprint edition of this 1934 book) by L. Prandtl and

O.G.Tietjens. Prandtl used flow visualization techniques and high speed movie cameras to show the streamlines around a wing section during the time it started its forward motion. At the trailing edge of the wing the flow velocity gets very high as the flow "tries" to go around the edge from below to above the wing as predicted in Figure 3b. However, friction keeps it

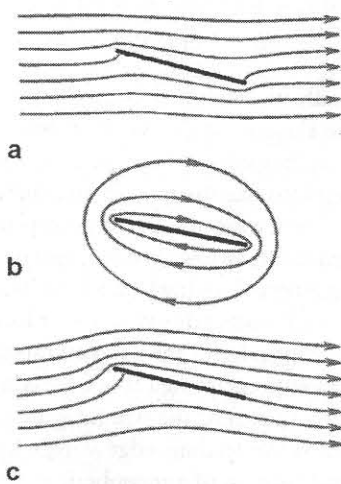


Figure 3.

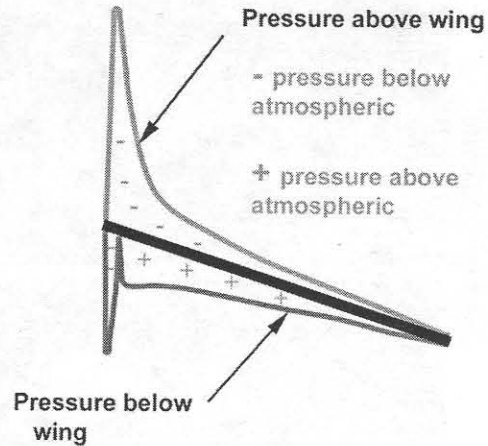


Figure 2.

from doing so, and instead a counterclockwise vortex is formed at the trailing edge of the wing (Figure 5a). As the wing moves forward, the vortex is left behind (Figure 5b-d). We can use conservation of angular momentum to predict that there must be a clockwise vortex in the field to balance the trailing vortex (the net vorticity must be zero). The clockwise vorticity that balances the vorticity in the trailing vortex is the circulation around the wing. The circulation strength builds up gradually and, once the shed vortex is a chord length or so back, it reaches its maximum level. Every time the lift on a wing increases, either from an increase in speed, and an increase in angle of attack, an additional counterclockwise vortex is shed from the trailing edge in an amount equal to the increased clockwise circulation around the wing.

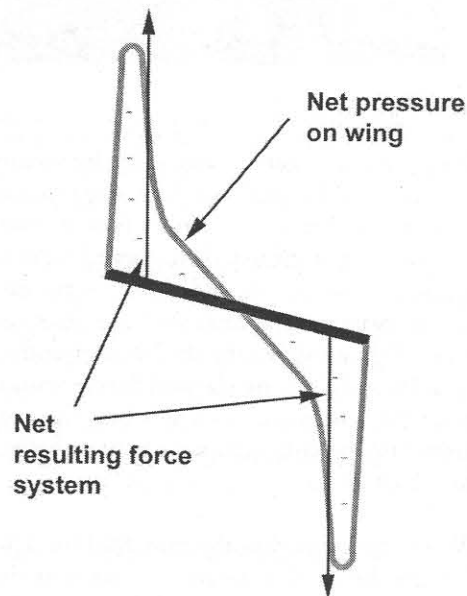


Figure 4.

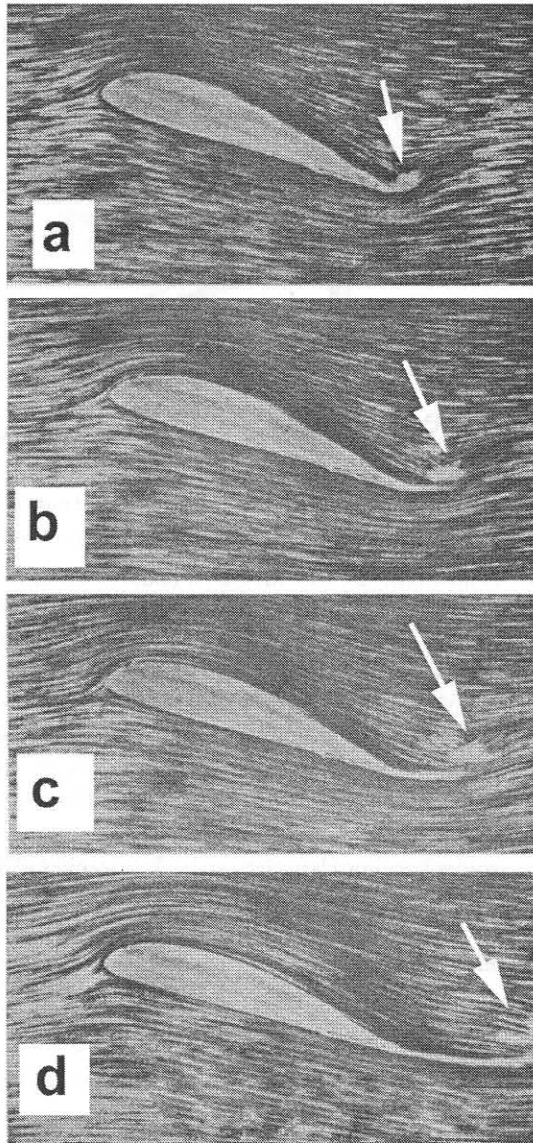


Figure 5.

The photos in Figure 5 were made by keeping the camera stationary. By allowing the camera to move with the wing, we can see the circulatory flow as shown in Figure 6. If the wing is started, then stopped suddenly, the wing no longer has any lift, and therefore has no circulation: the clockwise circulation is shed as a clockwise "stopping" vortex. Figure 7 shows the shed starting and stopping vortices. These figures are classical flow visualization images generated a hundred years ago, but they are timeless in their ability to enlighten us as to what happens when air flows past wings.

We can now envision the flow field for a wing moving through the air as a system of vortices as shown in Figure 8a, the circulation around the wing balanced by the trailing vortex and the tip vortices balancing one another.

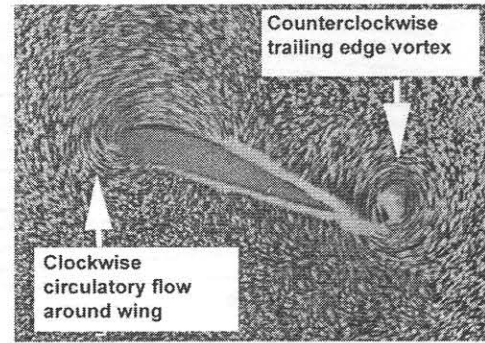


Figure 6.

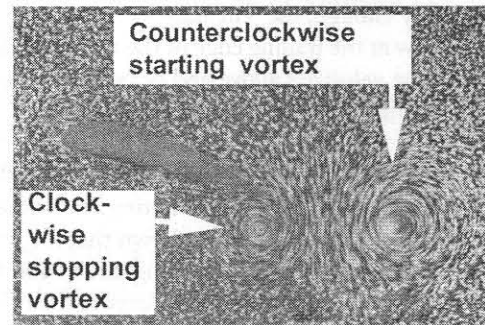


Figure 7.

After the wing moves far enough forward, the trailing vortex is left so far behind that it no longer influences the flow on the wing. At this time the vortex system is referred to as a "horseshoe" vortex, as shown in Figure 8b.

One interesting point is that since the "bound" vorticity (another name for the circulation) is balanced by the shed vorticity (the trailing vortex), we can in principle know the flow and therefore the aerodynamic forces on the wing if we can measure the shed vorticity or vortex wake of the wing. This has led to an entire field of investigation into visualizing and measuring the vortex wakes of flying birds and insects, especially by Russian researchers like Andrei Brodsky (1994).

Vorticity can generally be generated by any sharp edge at an angle to the flow. This means that vortices don't have to happen only at the trailing edges of wings. Supersonic airplanes have wing sections that are tapered to a sharp point at the leading edge. Delta winged supersonic airplanes like the Concorde, when flying at low subsonic speeds during takeoff and landing, where the wing is at a very large angle of attack, experience a leading edge vortex that forms just behind the swept leading edge of the wing and stays there. This vortex causes a low pressure area above the wing leading edge, augmenting the lift of the wing. Figure 9 shows a Concorde on which the leading edge vortex has been made visible by condensation of atmospheric moisture.

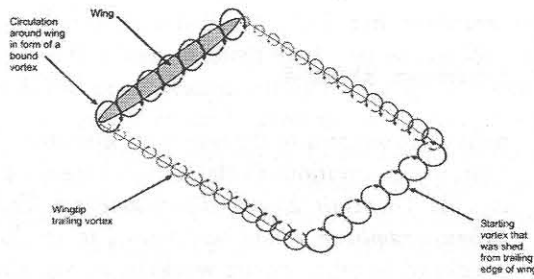


Figure 8a.

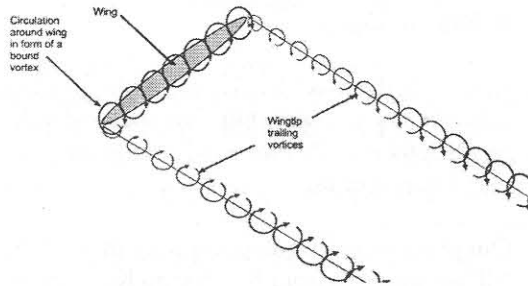


Figure 8b.

Insect wings often operate at high angles of attack, and both trailing and leading edge vortices can be of importance. We will talk about vortices and insect wings in the next installment.

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 the wing from leading to trailing edge is 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



Figure 9.

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.
- Whenever a wing accelerates forward or air accelerates past the wing, or its angle of attack is increased, the lift increases. This lift increase is accompanied by an increase in "circulation" about the wing, a circulatory flow that causes the air to flow smoothly from the wing trailing edge.
- Changes in circulation are accompanied by shedding of a vortex of equal magnitude and opposite rotation from the trailing edge—a "starting" vortex.
- The circulation, the starting vortex, and the wing tip vortices combine to form a closed vortex system that amounts to a square "vortex ring" (a smoke ring is a vortex ring—you may have seen your grandfather or father blow one). The vortex system can tell us much about the functioning of the wing since the vorticity is related to the strength of the circulation of the wing and thus to the amount of lift being generated.

Next time: Vortices and flapping flight.



Notes on Odonates of the Lower Keys

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Like many readers, visiting the Keys to see the specialties (*Lestes spumarius*, *Nebalennia minuta*, etc.) and new US records was part of my "great places to visit" file. This April an offer, by James "Skip" Lazell, of a campsite on Middle Torch Key plus a desire to follow up on the *Orthemis* question moved the Keys trip to the front burner. If you can find Lazell's "Wildlife of the Florida Keys" in your library it's worth a read. It will also tell you why the Keys Bunny Rabbit is named after the founder of Playboy.

I apologize, as a real novice on Keys biology, for even writing this article, but such an article would have been a great help to me before going. The information on ponds and their location should be useful to anyone. The species list and comments are for April 2005 and should be used with caution for other months or even other years. The other comments are of questionable validity but thrown out for consideration.

In retrospect we shouldn't have gone in April. This was the end of the dry season and not surprisingly all species were at low ebb and thoughts of looking for rare damselflies were abandoned quickly when we had trouble finding *Ischnura hastata*. August or September may be the best months—after the rains have started and before things start to dry up.

Most of the odonate species on the lower Keys are West Indian, and do not range very far up the Florida peninsula, if at all. Even the seaside dragonlet, *Erythrodiplax berenice*, is the West Indian form not the form found through the rest of Florida and up the east coast.

Our discovery of *Brachymesia herbida* in the Key West area (stock Island) illustrates the problem of surviving in an area where fresh water is limited and subject to extreme changes. Dunkle (1992—Distribution of . . . (Odonates) in Florida, Bull. DSA 1(2): 42.) says in regard to *Brachymesia herbida*: "Paulson . . . recorded the only 3 specimens taken in Florida, on Big Pine Key in 1960–61, the species was probably extirpated by the severe drought of 1961–1962." We found *Brachymesia herbida* common to abundant at Key West Botanical Garden and adjacent Golf Course although it has not reappeared on Big Pine. Extirpation due to severe drought must have happened periodically. Recolonization evidently comes from the West Indies (Cuba?) rather than from mainland Florida. The population of *B. herbida* on Key West may, therefore, be very recent and possibly transient. One should not be surprised if the same is true for other species. Thus conti-

nity from one year to the next is not guaranteed. Judging from my observations in the British Virgin Islands species like *Orthemis*, *Erythrodiplax umbrata*, *Tramea*, and *Ischnura ramburii* would be expected to recolonize very rapidly while other species would be slower. This may be what we are finding with *Brachymesia herbida*. (This species is now common in the Homestead area—extending its Florida range.)

If you visit the lower Keys a stop at the Key Deer Refuge visitor center is worthwhile. The staff and volunteers are very helpful and can give you directions to more wetlands than I visited or list in this article.

Our plan was to spend up to a week in the Keys and visit "all" the wetlands from Big Pine to Key West on the theory that any pond may contain a species not found on the others. As it turned out we spent five days and visited only part of the wetlands. The latter due in part to the abundance of ponds and difficulty of finding them and part to the futility of checking ponds in the wrong season.

Wetlands And Odonates

Orientation: On Big Pine, Highway 1 runs across the south end. The only traffic light is for Key Deer Boulevard which runs NNW to the end of island. Almost the first turn to the right off this road brings you into a shopping mall with the Refuge Visitor Center. Just about a mile north it crosses Watson Blvd. (blinking light), the other major street on the island. Following this west to the end brings you to the refuge headquarters. Following it east takes you onto No Name Island.

The following narrative concentrates on wetlands visited with incidental species comments. On the 4th evening of our stay there was about an inch of rain. This raised the level of small borrow pits over a foot and doubled or tripled their size. Swales and similar seasonal wetlands suddenly had 3–6 inches of water over extended area. The increased numbers of *Pantala flavescens* after the rains and the 3–4 fold increase in *Erythrodiplax umbrata* at small borrow pits were not surprising. However, *Erythemis vesiculosa*, which had been seen once in three days, was suddenly present at all the small borrow pits with 3–4 individuals patrolling each puddle. *Erythrodiplax berenice* ("E b" in the following notes) is, naturally, the most common odonate of the keys and appeared at all water in greater or lesser numbers with hordes in the mangrove areas.

Small borrow pits (those 30–40 feet in maximum length and 6–8 feet deep): Visited three sites on Big Pine, all of which had been cleaned out by the refuge crews in the last few years. Two are located across Highway 1 across from each other in vicinity of Loma Lane (one next to health food store, other next to marine supply store). The third, actually three pits in same area, is located at corner of Avenue B and South Street. I found *Orthemis*, *Pantala*, *Erythemis vesiculosa* and *Erythrodiplax umbrata* in small numbers and the occasional *Tramea*, *Ischnura ramburii* and *Brachymesia furcata* at all the small pits.

Only Blue Hole of the large borrow pits I visited seemed to have any odonates other than *Erythrodiplax berenice*. Blue Hole is 2.5 miles north on Key Deer Boulevard. If you go west around the south end of Blue Hole and stay on the northern most street until you're forced to turn south you will come to a gate and see a long narrow borrow pit to your southwest. This is supposed to be fresh and have alligators, but I found neither alligators or odonates other than *E. berenice*.

There are two large pits on No Name Island but these are active quarries and at least one seems to connect to tide flats. Another large borrow pit on south side of Highway 1 as you come onto the island is obviously connected to the ocean.

J. Daigle (2005, ARGIA 17(1): 10) mentions a large, and very productive, borrow pit at the north end of Big Pine—turn off Key Deer Boulevard onto Kyle Boulevard and continue to large apartment complex.

Swale wetlands: These swales are natural basins and now crisscrossed with “mosquito ditches” about a foot wide and two feet deep. The ditches have been blocked in numerous places and in early April were nearly full of water. Full means about an inch of water and 16 inches of suspended sediments and a lot of small fish. They were obviously not attractive to damselflies as I only found two *Ischnura hastata* in about three hours of crisscrossing the two areas I checked. The first swale is off the northern end of Key Deer Boulevard. Where that road takes its last turn north there is a gated trail leading back south. Park and fight through the brush to the edge of the wetland—also accessible slightly further south off Key Deer or by walking past gate and up trail, or even by following some of the nature trails further south on Key Deer Boulevard. The other swale crosses eastern Watson Blvd. about halfway to Avenue B. Just go past first house, park, and it should be to south. Only one good opening through brush. *Pantala*, *Tramea* and *Macrodiplax* were all recorded but only *Orthemis* and *Brachymesia furcata* were present in more than single numbers and they were widely scattered—ten and three respectively for two hours of walking.

Both areas looked like they would have excellent damselfly habitat in the wet season as there are numerous small depressions and marshy grasses in the dried up portions.

Natural ponds—not really happy with this designation, but they are basically uncleared ponds full of the same suspended sediments one finds in the mosquito ditches and often overgrown with trees. On No Name Key there is one such pond on last trail leading south from the main W–E road. Obvious as trail does a half moon bend around east side. On Middle Torch Key there are ponds on opposite sides of Middle Torch Road near its northern end. Just past house 2455. In April I found one *Ischnura hastata* but suspect things pick up in the rainy season. There are evidently more of these ponds on the Torch Keys and other Keys that I did not visit.

On Summerland Key take the first left after crossing bridge going west. Then first right on Margaret Avenue and first left. A very nice pond will be on your left. This is listed as fresh but in April only had *E b* and *Ischnura ramburii*.

On Sugarloaf Key if you turn north at the high school (obvious) there are low areas on both sides of road north of school that look like they should be fresh water swales in wet season. A small cattail filled pond at southwest corner of school ground (*i.e.* Rt. 1) looked good but didn't even have *Ischnura*.

On Stock Island (Key West) in the Key West Botanical Garden there are two ponds that have not progressed to the point of being totally clogged with suspended sediments and these were occupied by *Orthemis* and *Brachymesia herbida*. The surrounding hardwood hammock produced resting *Coryphaeschna*, *Brachymesia furcata*, *Erythrodiplax umbrata*, *Erythemis vesiculosa* and *simplicicollis* although none of these were seen on the ponds. A small ornamental waterfall and water lily pond at entrance to the garden was heavily populated with *Ischnura ramburii*—more than at the Summerland Key pond which was only other pond with other than token individuals.

Golf Course Ponds: This applies only to the Key West Golf Course on Stock Island—a fence separates the course from the Botanical Garden but doesn't prevent a steady accumulation of errant golf balls in the garden. There are 5–6 freshwater borrow pit ponds on the golf course in two rows starting at the club house. The pro shop and one security guard were very cooperative once I got through the gated community that controls entrance to the course. This is a public course so tell the guard you're going to the golf course. The edge of these ponds is primarily barren and mowed to pond edge. On some parts

of the shore there are "walls" of 4 foot high reeds and cattails. *Brachymesia furcata* was abundant, *Brachymesia herbida* was common, *Brachymesia gravida* uncommon while *Macrodiplax balteata* and *Erythrodiplax umbrata* are common to uncommon, *Orthemis* present in tiny numbers. These ponds may be successful because of the close proximity to the hardwood forest in the Botanical Garden.

The private golf course on Marathon Key has only brackish ponds and a visual inspection from road did not show any vegetation around the ponds.

If you go, would recommend the swales and smaller borrow pits on Big Pine over Blue Hole. No idea what ponds do in wet season so you're on your own. The Key West Botanical Garden should be visited in any season and probably the golf course.

Species List

We found only one *Erythemis simplicicollis* and no *Pachydiplax longipennis*. Suspect these and several other "common" species not found are much more common on the upper keys. Our final list of 15 for the lower keys is not even half of the species listed for the Keys, but probably average for April.

Ischnura hastata—Only 3–4 seen.

Ischnura ramburii—Spotty, common at a few sites but single individuals at others.

Coryphaeschna (viriditas)—One at botanical garden.

Brachymesia gravida—Uncommon with most seen on

golf course.

Brachymesia herbida—Common at golf course and botanical garden.

Brachymesia furcata—Abundant on golf course and uncommon at most other ponds on Stock Island and Big Pine.

Erythemis simplicicollis—One at botanical garden.

Erythemis vesiculosa—Common at several ponds on Big Pine after heavy rain.

Erythrodiplax berenice—Present at almost every water body and super abundant in mangrove areas.

Erythrodiplax umbrata—Spotty in distribution but more common after heavy rains.

Macrodiplax balteata—Fairly common at golf course and one on Big Pine.

Orthemis (Antillean species)—common on Big Pine at several ponds and less obvious at botanical garden and golf course.

Pantala flavescens—present in small numbers at several sites on Big Pine.

Tramea—single individuals at a number of ponds or over road and both *insularis* and *onusta* reasonably common.

Acknowledgments

Carolann Sharkey and Phillip Hughes at the Key West Botanical Garden, Dr. Philip Frank and William Miller at the Key Deer Refuge plus additional volunteers and staff members were all helpful and important to the success of the trip. Thanks to James (Skip) Lazell for providing the spur to get the trip started and George Tegzes for his hospitality on Middle Torch. ✕

Escaping Winter by Chasing County Records in Florida

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After a enjoyable but *Ophiogomphus*-free weekend on Eglin Air Force Base, Peggy and I were ready to leave the monsoons of the Panhandle and find the real Florida, the sunny odonate-rich Florida we had been promised. Yes, we had rain even without Nick there, and we are wondering if the Donnelly effect is an infectious disease and we are all carriers. We did find some interesting *Epithecina* before the meeting and *Ischnura prognata* (Holmes Co.)—filling in the tiny gap: "not found west of the Apalachicola River in the Panhandle."

This was a multipurpose trip, including, besides Niceville, visits with friends, an extended stay on the lower Keys, warmth, and a general tour of Florida. Why not scare up some county records along the way? Thanks to Nick Don-

nelly's dot maps and John Abbot's update of these maps in OdonataCentral it was easy to spot the counties that could use some collecting.

Chasing county records is an enjoyable addition to a trip, but it also sharpens ones awareness of species distribution and regional changes in abundance and habitat preferences. You gain confidence in identifying female odonates or at least find you can't do it. One may also find that super common things like *Ischnura ramburii* and *Pachydiplax longipennis* can be elusive.

Our first stop was at Econfina State Park south of Tallahassee in Taylor County. We walked around the flooded campground shielding our faces from the wind and of

course, carrying a net despite the overcast and cool temperatures. When we stopped to chat with another bored camper I realized there was something in the net. A teneral female *Nebalennia pallidula*—the northern most record for this elusive species. No idea what mud puddle or bit of lawn it came out of. Maybe there was hope after all.

A few days later we reached Lake Manatee State park, near Tampa, and found my first *Didymops floridensis* and county record for *Crocothemis servilia*. By then it was clear that this was a late and cool Spring. Most sites had more tenerals than adults and many of the *Enallagma* species one would expect just weren't there.

After a cold windy night in Collier County (Monument Lake near Monroe Station in Big Cypress country) with nothing to show but one *Nebalennia pallidula*, an alligator nest and young in front of the tent and panther droppings behind we were still searching for better tidings. And they arrived. At our lunch stop along the Tamiami Trail (11–12 miles west of Rt. 997 where one can cross to north side of canal), Peggy asked what all those small dark damselflies were. Perching on the ground or flying less than an inch above it in the short grass of the parking area were scores if not hundreds of *Nebalennia pallidula*. My previous encounters totaled five individuals so this was incredible. One could drop the net almost anywhere and get two or more. An *Enallagma vesperum* in the same group of insects was the southern-most Florida record.

On to the Keys (a separate article) and then back north a week plus later to Kissimmee Prairie State Park (north of Lake Okeechobee). If you want to get away from it all this is the place to go (20 miles from a numbered highway). Last year the odonates were just starting to come out so we arrived later this year and found the emergence even less advanced than in 2004. Not to worry, there were lots

of Caracaras to look at and I wasted my time prospecting in Indian River and St. Lucie Counties—southern-most record of *Calopteryx maculata*, several *Crocothemis servilia* and my first *Erythemis plebeja* for the states. Had found a teneral *Argia moesta* (southern-most record) south of Lake Okeechobee and left it alone expecting to find adults—never do that.

Then up to St. Augustine for a few nights (tick heaven) and Suwannee River for a few more nights (river out of its banks and every night in the 30s). Collected *Ischnura prognata* in all five counties checked. They look like stretch *I. ramburii* as they float through the wooded/brushy swamps and forested sink-hole ponds. Finally know, maybe, what habitat to look for and where in the habitat to find them. Also my first *Gomphus australis*.

On to Athens, Georgia where we experienced our first 80 degree days. Talked Theresa Thom into a wonderful day chasing odonates—what a change from Eglin. *Ischnura prognata* (the trip species) was found by Theresa, odonates were abundant and there were more *Didymops transversa* than I have ever seen.

We ended up with 102 records from 21 counties covering 50 species (23 damsels). Got 13 species from the best counties so hardly scratched the potential. With *Enallagma* being so scarce (although county records for 10 species) the commonest records were *Ischnura posita* (9 counties), *bastata* (8) and *prognata* (6). *Didymops* with five county records, and the various northern and southern range extensions were more impressive. 

Tauriphila australis (Hagen 1869) New for Lesser Antilles

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During a study of dragonflies larval habitats in Martinique (French West Indies) asked by the Direction Régionale de l'Environnement (DIREN) in March 2005, we found two males of *Tauriphila australis*. These specimens were caught on two different sites: Piton Crève Coeur (14° 27' 08.9"N 060° 51' 10.7"W) large pond with Water Hyacinth and *Miathyria marcella* and Lafayette (14°N 061°W) large pond invaded by Water Hyacinth (80%) with . . . *Miathyria marcella*. The specimens were observed hunting above masses of Water Hyacinth, and first mistaken with *Brachymesia furcata*. *T. australis* is known from

United States (Florida), Greater Antilles (Cuba, Dominican Republic, Puerto Rico, Haiti) and Mexico to south Brazil. This is the first occurrence in the Lesser Antilles.

An other species, *Macrothemis celeno* (Selys 1857), already known from Lesser Antilles is new from Martinique. Three exuviae were found fixed on the rocks in the bed of the Alma river (14°32'21.1"N 60°59'00.1"W). 

Southern Comfort

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After the 2005 Eglin AFB meeting in late March, I drove to Bogalusa, Louisiana in hopes of doing better in my search for southern *Ophiogomphus*. While everyone had a blast at Eglin, we did not see any of the new *Ophiogomphus* from Florida. However, last spring, Gayle and Jeanell Strickland of Baton Rouge, Louisiana, collected a teneral male of *O. australis* at Varnado just north of Bogalusa. To my knowledge, this was the first time *O. australis* was seen since 1987. It was feared that this species was extinct since no one had seen it since then.

The next day was a beautiful clear sunny day with not a cloud in the sky. I went to Pushepatapa Creek in Varnado, which is the type locality. Conditions looked great! The stream was low and wadeable with clear tannic water. Several nice-looking gravel bars were there. Odonates like *Gomphus exilis*, *G. hybridus*, and *G. lividus* were common. Other odonates seen were *Libellula semifasciata* and *Didymops transversa*. Despite ideal conditions, I did not see any *O. australis*. Not even a whiff of one!

Finally, I gave up and went upstream to Dollar Road where the old wooden bridge was closed to traffic. Once there, I started walking the trails alongside the bridge. For a moment, I thought I glimpsed a small gomphid with an orange club quickly flying away, but I wasn't sure. A few minutes later, among the *G. exilis* and *G. lividus* perched on the ground, I spied a nice *Ophiogomphus* male! It was perched on a weed head in the middle of the trail. Slowly, I approached it. Suddenly, it flew off and up into the sky. Oh well, at least they are here. I then went into the open fields to see if any were there. No such luck . . . just *G. exilis*, *G. hybridus*, and *G. lividus*. I decided to return to see if the male had come back to its perch. It did! With a quick swing, I scooped it up! Trembling, I transferred it to a cellophane envelope. Only then, did I let out a deep

breath and proceed to look at it closely. Yes! It was a nice mature male with full color. Looking around, I found two more males under similar conditions before dinner time rolled around. They behaved much like *Erpetogomphus designatus* in the field, perching on branches and vegetation two feet above the ground.

That evening, I called Gayle Strickland with the wonderful news and he decided to join me the next day. This time, we had no luck finding any to photograph. Gayle took two of the live males back to Baton Rouge where he photographed them. The photos are on his web site at <<http://public.fotki.com/gstrick3/>> where one can look at them.

I stayed in Bogalusa three more days without any luck due to rainy and stormy weather. I did put the time to good use by scouting the town of Bogalusa. While I stayed at the inexpensive La Floridan Inn Motel, I found better accommodations on the south side of town. The moderately priced Sportsman's Inn or the fancy Traveler's Rest has the facilities for a SE regional meeting similar to the Eglin AFB meetings. I will propose such a 2006 meeting at the upcoming Yazoo City 2005 SE regional meeting. Hopefully, we will have better luck in finding this elusive and rare dragonfly.

By the way, Giff Beaton has informed me that he collected an *Ophiogomphus incurvatus* male in SW Georgia about the same time I was catching *O. australis*. Photos are on his web site at <http://www.giffbeaton.com/Ophio.htm> where one can see them.

Hopefully, next year will be a banner year for southern Ophios and some lucky person will even catch them in Alabama and Florida! Good luck! 

A Request for Assistance: Untangling Large-Scale *Anax junius* Migration in North America

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In the fall of 2003, Mike May and Philip Corbet asked the North American odonatological community for assistance in studying the alleged long-distance migration of *Anax junius*, the common green darner. In this issue, I provide some updates on work in this area since 2003 (in a separate article), and I am making my own request

for assistance. There are several areas in which assistance would be gratefully received:

The collection of whole *A. junius* larvae for genetic analysis between the summer of 2005 and the summer of 2006 for molecular analysis. I will be happy to reimburse ship-

ping costs for larvae preserved with 90 percent (or greater) ethyl alcohol, with the date of collection and GPS coordinates of the collection site.

The identification of times and places in southern Canada and the eastern and southern U.S. where *A. junius* migration has been observed. Raptor migration sites may be good candidate locations for observations. I'd like to visit as many of these migration sites as possible in the fall of 2005 and spring of 2006.

The tracking of local *A. junius* larval emergence patterns. This work is certainly not glamorous, as Mike May and I both know. Tracking local emergence patterns simply means visiting a pond on a daily or weekly basis and counting *A. junius* exuviae. I've been monitoring ponds in Austin, Texas, and Caledon, Ontario, for about two years, and Mike has been working on a site in New Jersey for even longer. A number of other individuals are doing the same work elsewhere, including John and Sue Gregoire in New York. Sites located near where such data have been collected in the past (West Lafayette, Indiana, in the case of Wissinger [1988] and eastern North Carolina in the case of Paulson and Jenner [1971]) would be especially useful. We even lack baseline data for tropical areas in the U.S., Mexico or Latin America more generally, the western U.S., and most of Canada.

As stated above, I'll be driving a great deal during the early fall and following spring while collecting adults

and observing *A. junius* movement. With even a small amount of assistance from the odonatological community, I believe that we might be able to reveal much about large-scale patterns of dragonfly migration and, with some luck, even make some reasonable statements about the basis for such movement.

Contact Information

I strongly encourage those who are interested in helping to contact me directly. By e-mail, I can be reached at <johoma@mail.utexas.edu>. I can also be reached by mail at the University of Texas, Section of Integrative Biology, MS C0930, Austin, Texas 78712.

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Miscellaneous Notes on Robin J. Tillyard, the Famous Odonatologist and Fossil Insect Specialist

Roy Beckemeyer

While in South Africa attending a meeting on fossil insects earlier this year, I met an Australian, Robert Beattie, who is working on the Belmont (NSW) Upper Permian fossil beds that Robin Tillyard worked on in the 1930s. Robert had brought to the meeting a large file of photocopies of correspondence by and clippings about Tillyard. Most of the correspondence concerned fossil insects, but some of the clippings were obituaries written on the occasion of Tillyard's premature death in an accident in 1937. As they contained some information on his life and times, I have extracted a few brief items of interest.

From "The Sun", Wed. Jan. 13, 1937:

Science Loses A Great Man. Dr. Tillyard's Death At Goulburn. Injured when his car over-

turned near Goulburn yesterday, Dr. Robin J. Tillyard, former Commonwealth Government Entomologist, died today in Goulburn Hospital ... Dr. Tillyard was born at Norwich (England) 56 years ago, and was educated at Dover College and Queen's College, Cambridge. He had suffered considerably from ill-health, which was the cause of him being rejected for service in the British Army when a young man, and for service in the Great War with the A.I.F. Dr. Tillyard had a distinguished career at Cambridge, and won most of the honors offered by the Empire scientific organizations and universities. He came to Australia to avoid the rigors of the English climate, and from 1904 to 1913 he was Master of Science and Mathematics at Sydney Grammar

School. He was lecturer in zoology at Sydney University in 1917, and from 1919 to 1928 was chief of the biological department at the Cawthron Institute at Nelson, New Zealand. In 1928 he was appointed Chief Commonwealth Entomologist. Dr. Tillyard's daughter, Hope, who was injured in the smash yesterday, will remain in Goulburn Hospital for a few weeks ...

Tillyard had been injured in a number of accidents over the years. Another newspaper article from *The Sun*, Tues. Jan. 12, 1937 that recounted the accident contained the following information:

Dr. Tillyard was handicapped in his career by a long series of accidents and ill-health. From school, he passed into the British Army with a very high place, but the medical authorities of Woolwich had to reject him because of rheumatism. Eventually, after brilliant scholastic achievements at Oxford and Cambridge Universities, he was compelled by rheumatism to leave England for a warmer climate ... Shortly after the outbreak of war, he was badly injured in a

railway accident on the North Shore line, and for two years it was feared that he would never be able to work again. He had suffered concussion, a broken arm, and severe back injuries. He made a remarkable recovery, and pursued his studies and research. His back was bent by the accident, his height being reduced by at least five inches. Some years later, while he was engaged at the Cawthron Institute of Scientific Research in Nelson, New Zealand, he was involved in a motor car accident, his left arm being fractured. Subsequently, he suffered a fractured rib in a motor accident in America ..."

Given all of Tillyard's health problems, one wonders how he had the stamina to produce such a substantial and solid body of work, which included at least two major books, *The Insects of Australia*, and *The Biology of Dragonflies*, and many, many publications on dragonflies, fossil insects of the Permian of Kansas and of Belmont, Australia, as well as works on other groups of insects. For his brief and accident plagued life, he was truly a remarkably productive scientist.



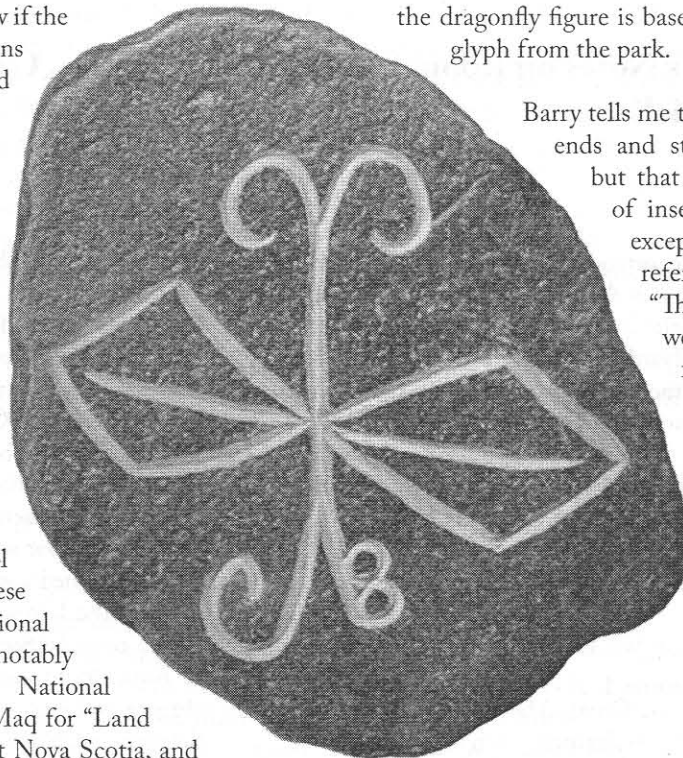
The Hunter

Paul-Michael Brunelle, <pmb@ns.sympatico.ca>

I have long wanted to know if the peoples of the First Nations in the Acadian region had beliefs regarding damselflies and dragonflies—as they do regarding many plants and animals.

My initial inquiries were unsuccessful, but for Christmas 2002 I received from Meredith Bell the delightful gift pictured below—a petroglyph of a dragonfly prepared by Mi'kmaq artist Barry Stevens, whose son Noah goes to school with my son Michael. These petroglyphs are a traditional Mi'kmaq art form, most notably displayed in Kejimikujik National Park (Kejimikujik is Mi'kmaq for "Land of the Lakes" in southwest Nova Scotia, and

the dragonfly figure is based upon an ancient petroglyph from the park.



Barry tells me that a lot of Mi'kmaq legends and stories are about animals, but that there is seldom mention of insects. The dragonfly is an exception, being respectfully referred to as Getanteget Jujij, "The Hunter", and is always a welcome sight during deerfly and horsefly season.

Anyone wanting further information about Barry should visit the site <<http://www3.ns.sympatico.ca/barry.stevens/>>.



Dragonfly Jazz—Aka Tombo

Roy Beckemeyer

Many of you are familiar with the Japanese folk song, "Aka Tombo" ("Red Dragonfly"). Perhaps you have heard it sung or have sung it yourself at a dragonfly meeting. The song has been performed recently by Canadian soprano saxophonist Jane Bunnett, an artist who has in the past done a lot of jazz with Cuban musicians. This album focuses on folk songs from around the world, including Japan (two songs, including Aka Tombo). The liner notes state that "... the story behind the composition ... is an old man reflecting on his past, his youth; as a dragonfly passes by and performs in front of him". Bunnett performs the song (written in 1921 by composer Kousaku Yamata)

with the accompaniment of a string quartet, and also a traditional jazz rhythm section of piano, bass, and drums. The tone of the soprano sax is particularly appropriate for this tune, and Jane and the other musicians do a very nice job. The CD containing the song is also named for it (Red Dragonfly: Aka Tombo on the Narada Jazz label, released in 2004), and has an attractive cover with an oriental style brush-stroke impressionistic dragonfly in black and the title in scarlet red. Now we have the option of listening to "dragonfly music" while watching or working with dragonflies! 

Ottawa DSA Annual Meeting Abstracts

An Overview of Community and Conservation Ecology Studies of Odonata in Mississippi Wetlands

Jason Bried

Invertebrates comprise a substantial proportion of secondary production in freshwater wetland ecosystems, yet studies of wetland insects focus only on the aquatic forms or on the transition to adulthood (emergence). Insect emergence represents a vital ontogenetic niche shift from a restricted aquatic existence as larvae to aerial modes that integrate wetlands with surrounding habitat. Therefore, study of post-emerged stages of wetland insects is necessary to gain more complete understanding of wetland biodiversity and function in the landscape.

The Odonata (damselflies, dragonflies) are relatively ubiquitous in permanently flooded freshwater wetlands, and they occupy a critical trophic niche in these systems. Furthermore, the adults are easily sampled animals that are sensitive to human disturbance and recommended for wetlands assessment in Europe, Japan, and South Africa. However, requisite baseline information about adult Odonata is lacking in wetlands of North America, which precludes any pragmatic or ecological advantages of using

adults for wetlands assessment. From studies conducted in northern Mississippi, USA, I attempted to build on the understanding that Odonata, in their adult stages, are potentially valuable for conservation of freshwater wetlands. I plan to give a brief summary of five projects:

1. Abundance patterns of dragonflies observed along a wetland buffer gradient.
2. Fine-scale feedback of dragonfly abundance to wetland vegetation removal.
3. A spatiotemporal assessment of length-mass allometry using five dragonfly species.
4. Wetland patch occurrences of adult Odonata, and the importance of physical gradients. (presented as a poster)
5. Conservation umbrella potential of wetland Odonata.

Wing venation patterns: due to Flight Behaviour or Familial Relationship?

Jessica Ware, Rutgers University, Department of Entomology, 93 Lipman Drive, New Brunswick, NJ, 08901, <jware42@rci.rutgers.edu> 732-932-8872 (lab 1), 732-932-4238 (lab 2), 732-317-2148 (home)

Odonate families differ greatly in their wing venation: the number of crossveins, the vein angles and placement of their triangles or quadrangles varies. Wing veins have been used as characters to define familial relationships

among the Odonata. The mechanics of flight, however, may have necessitated the evolution (and maintenance) of certain wing vein patterns. The flight behaviour of odonates may be limited by the wing's morphology. As

a result, wing vein patterns may be prone to convergence, making them potentially poor characters for phylogenetic inference. To explore whether wing vein patterns were due to taxonomic family groupings or flight behaviour, I used

an image analysis software to measure the wing veins of scanned odonates. I completed a series of ANOVAs (an analysis of variance) on odonates grouped by family and grouped by flight behaviour.

Conspicuous colouration in males of the damselfly *Nehalennia irene* (Zygoptera: Coenagrionidae): do males signal their unprofitability to other males?

C.D. Beatty and T.N. Sherratt, Department of Biology, Carleton University, 1125 Colonel By Drive, Ottawa, Ontario, K1S 5B6, Canada

Damselflies in the family Coenagrionidae (Insecta: Odonata) are characteristically sexually dimorphic, with conspicuously coloured males and predominantly drab females. This sexual dimorphism is commonly explained as a consequence of selection on traits that increase male attractiveness to females. However, males of Coenagrionid damselflies are non-territorial and do not engage in displays, with male competition for mates resembling a "scramble". One alternative explanation for the sexual differences in colouration within these species has been suggested: that sexual dimorphism has evolved in this group primarily as a form of sex-related warning colouration. Here we test this suggestion by comparing the survivor-

ship of males of the species *Nehalennia irene* that have been painted in such a way as to make them look similar to an unaltered male (painted blue), simply different from the male (painted orange) or more like the gynomorphic female (painted black). Preliminary results indicate that in cage experiments with painted males and females that blue-painted males have significantly lower harassment by other males than black-painted males, and that under some conditions blue-painted males have higher survivorship than black-painted males. These results suggest that males are differentially harassed based on their colouration and that this harassment could equate to differential survivorship.

Mimicry Through Dragonfly Eyes

A. Rashed, C.D. Beatty, M.R. Forbes and T.N. Sherratt, Department of Biology, Carleton University, 1125 Colonel By Drive, Ottawa, Ontario, K1S 5B6, Canada

Although most of the studies on the evolution of mimicry and warning signals in insects have considered birds as the main predators, it is quite possible that predation by other taxonomic groups—such as insects—far exceeds avian predation at some localities. Yet very few studies have investigated the possibility that insect predators might facilitate selection for warning colours and mimicry in other insects. We experimentally evaluated whether prey size and/or wasp-like colours and patterns was important in deterring attacks by dragonflies, using pairwise and single presentations of both natural and artificial prey in the

field. Dragonflies were more likely to attack smaller natural and smaller artificial prey. However, dragonflies did not show reduced attacks on prey with wasp-like colours and patterns compared to the same-sized prey that were non-mimetic. Moreover, dragonflies avoided attacking both mock-painted and black-painted wasps entirely. Overall, we found no evidence in this study to support the contention that wasp-like warning signals protect small insect prey from attack by dragonflies, although size seems to play an important role in dragonfly prey choice. ✈

Book Review: Dragonflies and Damselflies of Texas and the South-Central States, by John C. Abbott. Princeton University Press, 2005, 344 pp. plus 64 color plates. \$29.95.

reviewed by **Nick Donnelly**

With the publication of this important guide, a large hole has been filled for odonatists living in the "hottest" part of the North American odonate world. John Abbott has provided an immense service for the growing body of ode watchers in Texas, and also in the surrounding states, with his very useful and thorough guide.

Starting with a thorough introduction and presentation of basic morphology, Abbott presents descriptions and keys to a large fauna, which comprises 243 species—well more than half of the entire North American fauna, and includes most of the northern Mexican fauna as well. For identification, Abbott provides keys to all levels of

taxa. Accompanying these keys are line drawings of many groups illustrating many of the features cited in the keys. For most of the species, there are excellent color photographs which show the colors far more effectively than even the most complete verbal description. There are range maps for all species, and he refers each species to its appropriate biotic province.

Abbott discusses the problems for identification among the myriad puzzling species which have caused great difficulties, especially for beginners, and he largely succeeds in presenting the significant distinctions. Thus, *Orthemis discolor* (orange-bellied skimmer, now called carmine skimmer) is identified regularly in south Texas; formerly all of these were passed over as *O. ferruginea*, the roseate skimmer.

There are a few shortcomings in this excellent manual. The keys for *Epithea* seem to be a bit muddled, with parts of the couplets for *cynosura* and *petechialis* apparently interchanged. The color photograph of *costalis* seems to be *cynosura* instead. This is perhaps the most challenging group in the entire North American fauna, and the last word has not been written about it. The *Stylogomphus* occurring in the northeastern part of this manual's range was described as *sigmastylus* nearly two years ago by Cook and Lauder milk, but here carries its old name *albistylus*.

I spent several weeks in Texas more than fifty years ago, when the most up-to-date literature available was the *Biologia Centrali Americana*. I could have identified my material with confidence had this manual been available. There is an entire new generation that will now do so, and I predict an enthusiastic reception for this excellent book. ✖

Book Review: A Field Guide to the Damselflies of South Africa, by Warwick and Michele Tarboton. 95 pp., numerous color illustrations. Privately published; available from authors <wtarbotn@iafrica.com> or from Russel Friedman Books, South Africa. The price is R150, which is about \$25 US.

reviewed by Nick Donnelly

In Jan 2004 I reviewed the first Tarboton book, which was a guide to the dragonflies (Anisoptera) of South Africa. The first guide was one of the best Anisoptera guides for any place in the world, and I recommended it for travelers to most of Africa. Although it came out after my second trip to Uganda, I could have profited immensely from it during two trips to that country. I find the second book equally superior, and I repeat my recommendation.

I am immensely impressed by this book. The organization of the book is the same as for dragonflies: the families are keyed in an illustrated, simple key, stressing venation. Readers are cautioned that representatives of these families in other parts of the world may not key satisfactorily, but this is a very minor point.

There are 67 species of Zygoptera in South Africa. Of the seven families the calopterygids, lestids, and protoneurids, each have a single genus; the chlorocyphids and synlestids have two, the platynemidids have three, and the coenagrionids have six genera. The first six families are not keyed to genus, but the accompanying discussions will enable placement to genus quickly. The coenagrionids are also not keyed to genus, but an explanatory page outlines the salient features of each genus. Unfortunately, the characters of *Aciagrion*, which has only recently been found in the republic, are rather brief, nor are individual species descriptions given.

The species descriptions are very complete, with full body scans (more than life size, fortunately, and most with wing venation) and drawings of the terminal appendages, as well as a range map and notes on habits, etc. Where there are color morphs, or significant differences with age, there are multiple illustrations showing these.

There are a few genera which will give the beginner some difficulty, and these are discussed rather thoroughly. *Lestes* is not keyed in the conventional sense but is outlined in an illustrated page, as well as the individual descriptions and figures. *Chlorolestes* and *Ecchlorolestes* are treated similarly. In these two very useful illustrated diagnoses, only common names are given, forcing the user who is familiar with scientific name to pencil these into the two pages.

The genus "*Enallagma*" is broken into the three that Mike May revived recently, but the diagnostic differences among them may not be useful to the beginner. Identification, however, will be straight forward, and the illustrations are excellent. *Agriocnemis* has five species; males are easily identified, but females will give problems. I wish that they had included diagrams of the female prothorax to help with this problem.

The genus that gives fits to all odonatists who are new to Africa is *Pseudagrion*. The Tarbotons retain Pinhey's A and B grouping, but seem to emphasize the development of pruinosity in males. I find this distinction much

less informative than the spines on the tenth segment and shape of the terminal appendages. Their discussion of the main groups further divide the groups into subgroups of up to four species, and the beginner will not find it difficult to proceed to species. Of the 23 species in South Africa, I have taken eight in Uganda, and most of these were difficult for me to identify, even using Pinhey's very useful

1964 summary of the genus. (One of the South African species was described subsequently.). I wish I had had the Tarboton guide in hand during those trips!

In summary, this book belongs into the small group of "must-own" guides to Odonata. Now I have to scratch up two air fares for a trip. ✈

Book Notice: Atlas of Missouri Odonata, revised April 2005. Compiled by Linden Trial, Missouri Dept. of Conservation, 1110 South College Ave., Columbia, MO 65201

This atlas supplants the 1st edition, which was published in September 2002. Several problematical species have been removed and other corrections made. The wealth of new

material is impressive, and the ranges of most Missouri species are now neatly shown to be well defined areas. ✈

16th International Symposium of Odonatology

Bastiaan Kiauta has announced that the 16th International Symposium of Odonatology will take place in Hong Kong

in July 2006. Further details will be announced. ✈

TRAMEA

Ontario Odonata Atlas Web Site

Colin Jones, Natural Heritage Project Zoologist, Ontario Natural Heritage Information Centre, Ontario Ministry of Natural Resources, 300 Water St., 2nd Floor N., P.O. Box 7000, Peterborough, Ontario K9J 8M5, Tel: 705-755-2166, Fax: 705-755-2168 <colin.jones@mnr.gov.on.ca>, <<http://www.mnr.gov.on.ca/MNR/nhic/nhic.cfm>>

With great pleasure I would like to announce the launch of the Ontario Odonata Atlas web site <<http://nhic.mnr.gov.on.ca/MNR/nhic/odonates/atlas.html>> — a joint project between the Ontario Natural Heritage Information Centre (NHIC), the Toronto Entomologists' Association (TEA) and the editors of Ontario Odonata.

A little background: The Atlas of Ontario Odonata project was initiated in 1995 by Don Sutherland of the NHIC, Ontario Ministry of Natural Resources in an effort to compile all available information on the distribution and abundance of the Odonata of Ontario. In 1998, Matt Holder and Andrea Kingsley were contracted by the NHIC to conduct a further survey of Odonata collections at ROM, CNC, and University of Guelph, primarily to compile additional specimen data for rare species. Beginning with the 1999 season, as a result of increased interest in dragonflies and damselflies, and in order to have a means of compiling records on an annual basis, Paul Catling, Paul Pratt, and myself began an annual summary of Odonata recorded in Ontario. These records are published by TEA in an annual publication entitled Ontario

Odonata (see <http://www.ontarioinsects.org/publications.htm>). Ontario Odonata also provides a means of publishing papers and notes on interesting observations and behaviour, range extensions, regional lists, and other subjects related to the study of Odonata in Ontario. The Ontario Odonata Atlas Database currently contains over 40,000 geo-referenced records of Odonata from Ontario and each year I add the records submitted through the annual Ontario Odonata summary (usually 5,000 records or more per year).

The Ontario Odonata Atlas web site is hosted on the NHIC web site and features distribution maps (plotted by 10 × 10 km squares) for each of the 167 Odonata species known to occur in Ontario, as well as a few subspecies/forms (e.g. *Aeshna interrupta interrupta* and *A. i. lineata*). Two species new to Ontario that were discovered in 2002 and 2003 (*Somatochlora linearis* and *Neurocordulia michaeli*, respectively) currently do not have maps. The species maps will be updated at least on a yearly basis, following the completion of each year's Ontario Odonata summary, and will be updated shortly with the 2003 summary data. If

when viewing the maps, they are automatically resized by your web browser in order to fit into your window, the text in the legend usually becomes hard to read. If this is the case, simply zoom in and the text becomes readable.

The site also features background information on the Ontario Odonata Atlas and the annual Ontario Odonata summary, information on how people can contribute records (including a template for data submission), a list of contributors, acknowledgements, and the conservation ranks for Ontario's Odonata.

Additionally, the Ontario Odonata Atlas web site contains information on the 2005 Dragonfly Society of the

Americas Meeting to be held in Arnprior, Ontario 8-12 July, including information on how to register and the current list of attendees. If you are planning on attending the meeting, please visit the site and follow the instructions on how to register.

With time, I hope to add photographs to the web site for each of Ontario's species.

I welcome any comments, feedback or suggestions you may have.



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The editor is able to provide back issues of *Argia*. Please contact T. Donnelly, 2091 Partridge Lane, Binghamton, NY 13903. 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 are \$3.00 per issue; this does not include postage; see below.**

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Binghamton, New York

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Above: A friend with great taste in old sports cars sent me this picture of the hood ornament from a 1938 Delahaye. Surely this is the most famous of all automotive dragonflies.

Below: *Cordulagomphus*, from the Santana Formation of Brazil (Early Cretaceous, 120 million years). Check out the antenodal cross-veins.

