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## CalOdes Dragonfly Blitz, 27–30 June, 2014, in the Warner Mountains of Modoc County, California

Kathy Biggs <bigsnest@sonic.net>

Oh my! Our problems started even before the Blitz's official start date. You see, although the state is in severe drought, the folks who arrived a day early to hold down campsites for us (it was first come, first served) got a cold, cold, drenching which made the entry road nearly impossible to navigate safely if you didn't have 4-wheel drive. We won't name names, but two participants bailed on us that very next morning!! We'd camped at Cave Lake twice before on Blitzes, even in the rain, but this was an off-the-charts rain storm, brutally cold with heavy, heavy rain. Luckily for the rest of us and the few folks who opted to stay in motels in nearby Alturas, the next few days were sunny and clear.

The California Blitz crew this year consisted of 10 folks: Kathy & Dave Biggs, Kevin & Tera McKereghan, Sandra Hunt-von Arb, Leslie Flint, Dave Welling, Matthew Matthiessen, Dennis Deck, and Norm Barrett. These last two participants came down from Oregon and we greatly appreciated their knowledge of Oregon odes. Sadly, we didn't ever have to use that expertise on a new California



Ash Creek Campground, Lassen County, California. Photo by Kathy Biggs.

state record. Kevin had experience in the area and led our field trips—THANKS!!

Our next problem was that this year's CalOdes Dragonfly Blitz was to be a combination Butterfly Count/Dragonfly Blitz. We'd often wondered if this would work. The butterfly count was brand new, coordinated by an experienced butterflyer who is also an experienced dragonflyer. It really was a good idea, but in reality it didn't work well except to get some butterfly people to stay on for the last days of the Blitz, and the Ode folks did photograph any Leps that they saw on the Butterfly Count day.

Also, although the Warner Mountains are a very special area with many species possible that don't appear in other areas of California, both Ode and Lep-wise, the severe drought had completely dried up many of our target locations (even the huge, but shallow, Goose Lake), making finding those unusual species difficult.

A pleasant surprise, though, was a place named Dismal Swamp, which the Lep folks had accessed on the count day. Based on their rave reviews, we decided to try it, despite its, well, dismal name. It was GORGEOUS!! Wet meadows that abounded with wildflowers greeted us, and we found more Mountain Emeralds (*Somatochlora semicircularis*) than any of us had ever seen in one place before.

But I'm getting ahead of myself. Let's start at the beginning! On Friday, we started picking up participants as we drove towards Modoc County; many of us met in Lassen County at the Ash Creek Campground to caravan the rest of the way. Great Basin Snaketails (*Ophiogomphus morrisoni*) and Grappletails (*Octogomphus specularis*) were

*continued next page...*

### Calendar of Events

For additional information, see <<http://www.odonatacentral.org/index.php/PageAction.get/name/DSAOtherMeetings>>.

Event	Date	Location	Contact
DSA Central America	31 May–9 June 2015	Costa Rica	Marla Garrison <mgarrison@mchenry.edu>
2015 Annual DSA Meeting	25–28 June 2015	Pennsylvania	Contact person to be determined
SE DSA Meeting	24–26 July, 2015	Erwin, Tennessee	Steve Krotzer <rskrotze@gmail.com>
SW Dragonfly Blitz	27–30 August, 2015	Sierra Co., New Mexico	Kathy & Dave Biggs <bigsnest@sonic.net>

continued from previous page...

highlights on that stop; the Snaketail was a lifer for several folks. We greeted Leslie Flint, a real trooper who held the campground for us despite the weather, at the Cave Lake Campground that night after a yummy dinner in Alturas.

On Day 2, which included the Butterfly Count, all the Ode folks decided they'd rather concentrate on odonates, instead of being assigned a butterfly territory. We started at an unknown farm pond which Kevin McKereghan, who has a summer home nearby, knew of. The abundance of species there was a good way to start the day. Then we headed to the Hot Springs, as this was to be the coolest day of the Blitz and the springs are in the hot desert. Applegate Hot Springs did not let us down. Here we found Pale Snaketails (*Ophiogomphus severus*), Desert Whitetails (*Plathemis subornata*), Paiute Dancers (*Argia alberta*), and Hoary,



Dave Welling provides a perch for a Shadow Darner (*Aeshna umbrosa*). Photo by Kathy Biggs.

Bleached and Comanche Skimmers (*Libellula nodisticta*, *L. compositus* and *L. comanche*) among others, all of which are not found in any other parts of northern California and were lifers for several folks.

We then rushed back across the Warner Mountains to get to the North Fork of the Pit River. Amazingly, it was chock-a-block full of more Pale Snaketails, and the much sought-after River Jewelwings (*Calopteryx aequabilis*), another species only found in the far northern reaches of California. We ended the day at Lower Lily Pond and a nearby wet meadow where the *Sympetrum* confused us.

After a sweet night sleeping alongside the gurgling brook at Cave Lake Campground, Day 3, which was forecast to be our hottest day, took us to utterly beautiful Dismal Swamp. At above 6000 feet the temperature was quite favorable for humans and the aforementioned Mountain Emeralds (*Somatochlora semicircularis*), which were joined by Hudsonian Whiteface



Sooty Dancer (*Argia lugens*). Photo by Kathy Biggs.



Pale Snaketail (*Ophiogomphus severus*). Photo by Kathy Biggs.

(*Leucorrhinia hudsonica*; the last report of 2014 for this species) and Dot-tailed Whiteface (*L. intacta*).

On the way out of the swamp, Sandra, Dave, and Kathy noticed a sign—Mineral Springs, 1 mile! Well, that sounded too good to not check out; it turned out to be a GORGEOUS place, and we added one species to the Modoc County list: Crimson-ringed Whiteface (*Leucorrhinia glacialis*).

From there, we headed back to lower Lily Lake to try to make heads or tails of those *Sympetrum*! We especially wanted to find Saffron-winged Meadowhawks (*S. costiferum*), as it would be a lifer for several desperados. Alas, every one we found was later re-identified as another species when we submitted photos to Western Odonata (thanks, Jim Johnson!). But at least a new early date for Shadow Darner (*Aeshna umbrata*) was established when a 'friendly' one used Dave Welling for its maiden flight perch! In the meantime, Kathy and Sandra literally took a break IN the water.

The 4th day we parted ways, heading home to the north, west and south. We'd seen some beautiful scenery, had fun together, and many folks had added to their life lists. We saw 50 species total; of these, 44 were seen Modoc County, thus accounting for two-thirds of that county's 67 species!!

### CalOdes 2014 Blitz Species List


An asterisk indicates that the sighting was either the first (F) or last (L) of the year for that species in 2014.

- \*River Jewelwing (*Calopteryx aequabilis*), L
- American Rubyspot (*Hetaerina americana*)
- Emerald Spreadwing (*Lestes dryas*)
- \*Spotted Spreadwing (*L. congener*), F
- \*Western Red Damsel (*Amphiagrion abbreviatum*), F
- Paiute Dancer (*Argia alberta*), F, 1st Northern California report
- Emma's Dancer (*A. emma*)
- Sooty Dancer (*A. lugens*)
- Vivid Dancer (*A. vivida*)

Boreal Bluet (*Enallagma boreale*)  
 Tule Bluet (*E. carunculatum*)  
 Pacific Forktail (*Ischnura cervula*)  
 Black-fronted Forktail (*I. denticollis*)  
 Western Forktail (*I. perparva*)  
 Shadow Darner (*Aeshna umbrosa*), new early date; previous early date 10 July 2007, ID by Dennis Paulson  
 Common Green Darner (*Anax junius*)  
 California Darner (*Rhionaeschna californica*)  
 Blue-eyed Darner (*R. multicolor*)  
 Pale Snaketail (*Ophiogomphus severus*), only report in 2014  
 American Emerald (*Cordulia sburtleffii*)  
 \*Mountain Emerald (*Somatochlora semicircularis*), F  
 Western Pondhawk (*Erythemis collocata*)  
 \*Crimson-ringed Whiteface (*Leucorrhinia glacialis*), L; male & female photographed, ID by Jim Johnson  
 \*Hudsonian Whiteface (*L. hudsonica*), L  
 Dot-tailed Whiteface (*L. intacta*)  
 Comanche Skimmer (*Libellula comanche*)  
 Bleached Skimmer (*L. compositus*)  
 Eight-spotted Skimmer (*L. forensis*)  
 Hoary Skimmer (*L. nodisticta*)  
 Twelve-spotted Skimmer (*L. pulchella*)  
 Four-spotted Skimmer (*L. quadrimaculata*)  
 Blue Dasher (*Pachydiplax longipennis*)  
 Glider species (*Pantala*)  
 Common Whitetail (*Plathemis lydia*)  
 Desert Whitetail (*P. subornata*)  
 Variegated Meadowhawk (*Sympetrum corruptum*)  
 \*Saffron-winged Meadowhawk (*S. costiferum*), F; record is questionable, as most if not all photos have been Red-veined Meadowhawk (*S. madidum*)  
 \*Black Meadowhawk (*S. danae*), F

Cardinal Meadowhawk (*S. illotum*)  
 \*Cherry-faced Meadowhawk (*S. internum*), only report for 2014; ID of photo of female by Jim Johnson  
 Striped Meadowhawk (*S. pallipes*)  
 Red-veined Meadowhawk (*S. madidum*), ID of photo of female by Jim Johnson  
 \*Band-winged Meadowhawk (*S. semicinctum*), F  
 Black Saddlebags (*Tramea lacerata*)

Species seen in Lassen but not Modoc County, 26 & 28 June:

\*River Bluet (*Enallagma anna*), F  
 Arroyo Bluet (*E. praevarum*), may need documentation  
 Grappletail (*Octogomphus specularis*)  
 Great Basin Snaketail (*Ophiogomphus morrisoni*)  
 Pacific Clubtail (*Gomphus kurilis*), Blue Lake, 28 July  
 Pacific Spiketail (*Cordulegaster dorsalis*) exuvia; confirmed by Tim Manolis 



Kathy & Dave Biggs, Sandra Hunt-von Arb, Leslie Flint, Dave Welling, Matthew Mattiessen. Photo by Sandra Hunt-von Arb.

## 13th Annual Bitter Lake National Wildlife Refuge Dragonfly Festival

Bill Flynt <flynt@plateautel.net>

The thirteenth edition of the Friends of Bitter Lake National Wildlife Refuge Dragonfly Festival, near Roswell, New Mexico, was held over the weekend of 11–13 September 2014. We had over 1,100 visitors to the Refuge during the Friday evening and two weekend days of this year's event.

The two-hour Dragonfly Tours (led by experts Karen Gaines, Jerry Hatfield, James Lasswell, Bill Lindemann and Robert Larsen) and the Refuge Wildlife Tours (given by refuge biologist Jeff Sanchez) were all full. Space on the tours must be reserved in advance and these were as popular as ever. We did allow people to use their own vehicles to follow the tour vans around, to accommodate additional participants once the tours were all full. There was also a Birding Tour early on Saturday morning, escorted by Jim

Montgomery and Cecil Kimberlin.

Saturday was a full day of hour-long presentations in the auditorium of the Visitors Center. Presentations were very well attended and addressed topics such as dragonflies, hummingbirds, monarch butterflies, reptiles, and landscape photography.



Blue-eyed Darner (*Rhionaeschna multicolor*) in flight. Photo by Bill Flynt.

The young crowd always has plenty of events scheduled to keep them entertained, including our Kid's Wildlife Discovery Tour "to learn about and handle a variety of plants and animals". They also learn about animal capturing techniques used for biological studies on the refuge. There are arts and crafts and face painting for the youngsters as well as a fishing tank full of catfish and archery practice, both provided by the New Mexico Department of Game and Fish.

The 4th annual Dragonfly Photography Workshop was held again this year during the festival. This workshop is led by Clifford Powell, who is assisted by members of the Photographic Arts Society of Roswell. Proceeds from the workshop are donated to the Friends of Bitter Lake every year and are very much appreciated.

Roswell has experienced an awful lot of rainfall this year (yea!) and tours were limited to the main refuge drive because of an abundance of mud. It was raining in town all Saturday morning, but the Refuge manager Floyd Truetken called several radio stations in Roswell to tell them we were going full bore—they announced it over the air and we got a bigger crowd.



James Lasswell (L) and Jerry Hatfield (R), two of our Dragonfly Tour experts. Photo by Bill Flynt.

Thanks to everyone involved, we had another very successful event. We are looking forward to next year's Dragonfly Festival, which is always scheduled for the weekend following Labor Day. Please come and join us! For more information, please call the Bitter Lake Visitors Center at 575-622-6755, or visit us on the Web at <[http://www.fws.gov/refuge/Bitter\\_Lake/](http://www.fws.gov/refuge/Bitter_Lake/)> or <<http://www.friendsofbitterlake.com>>.



## 2015 Southeastern DSA Regional Meeting

**Steve Krotzer** <[rskrotze@gmail.com](mailto:rskrotze@gmail.com)>, **Richard Connors** <[rconnorsphoto@aol.com](mailto:rconnorsphoto@aol.com)>, and **Larry Everett** <[fattigia@aol.com](mailto:fattigia@aol.com)>

The 2015 southeastern DSA meeting will be held July 24–26 in Erwin, Tennessee. Erwin is located in the Appalachian Mountains of Unicoi County in the northeastern part of the state, about 15 miles south of Johnson City, 100 miles east of Knoxville, and 45 miles north of Asheville, North Carolina.

Erwin is not a huge town, but it has all the basic requirements for a southeastern DSA regional meeting: enough different lodging options to meet every budget; a Wal-Mart; and a Mexican restaurant!

The "official" headquarters for the meeting will be at the Mountain Inn and Suites (423-743-4100; <[erwinmountaininn.com](http://erwinmountaininn.com)>). There are additional hotels nearby, including a Super 8 in Erwin (423-743-0200), as well as a Budget Inn in Unicoi and a variety of lodging options in Johnson City. There are also several private and Forest Service campgrounds in the vicinity. There are a few fast food and other dining options in Erwin, and a lot of additional choices in Johnson City.

It will be hot, but there should be plenty of occasions to cool your ankles in a beautiful Tennessee mountain stream! We will have an opportunity to add to the species list for several of the counties near Erwin. There are a variety of potential collecting localities in the vicinity, including National Forest lands, several state parks, a Nature Conservancy site, and some smaller private properties.

We are working to get permission to collect on as many of these sites as possible. In addition to the usual assortment of "summer" species, we hope to find a few of the area's specialties, such as *Enallagma bageni* (Hagen's Bluet), *Cordulegaster erronea* (Tiger Spiketail), *Aeshna umbrosa* (Shadow Darner), and *Somatochlora elongata* (Ski-tipped Emerald). These species, while common in other parts of the country, are not easy to find in the southeast.

We hope you can join us for what should be a fun and productive meeting. If you have any questions or need additional information, feel free to e-mail Steve at <[rskrotze@gmail.com](mailto:rskrotze@gmail.com)>. Please let us know if you are planning to attend. We are looking forward to seeing you there!!




## 2015 Southwest Dragonfly Blitz

Kathy Biggs <bigsnest@sonic.net>

The 2015 Southwest Dragonfly Blitz will take place on 27–30 July at the City of Rocks State Park in Sierra County, New Mexico (see <<http://www.emnrd.state.nm.us/SPD/cityofrocksstatepark.html>>). The event will be hosted and coordinated by Tony and Shela Godfrey, who can be contacted at <[artfullbirds@yahoo.com](mailto:artfullbirds@yahoo.com)>, and co-coordinated by Kathy and Dave Biggs, who can be contacted at <bigsnest@sonic.net>.

The gorgeous City of Rocks State Park is located about halfway between Deming and Silver City in southwest New Mexico, within a few miles of Dashed Ring-

tails (*Erpetogomphus heterodon*), Arizona Snaketails (*Ophiogomphus arizonicus*), and other unique southwestern species. Areas nearby have cienegas and hot springs that have not even been explored for Odes yet! This is near the area where the Godfreys found the first USA record for West Mexican Leaf-tail (*Phyllogomphoides nayaritensis*). Who knows what else we may find?

Besides the reserved group campground, which has hot showers and a visitors center, many hotels are located in nearby Silver City and Deming. Let us know if you are interested! 

## The 2014 Northeast DSA Meeting

Bryan Pfeiffer <bryan@bryanpfeiffer.com>

If you're searching for dragonflies around the home turf of Nick and Ailsa Donnelly, it might seem that there would be little new to find under the sun (or in the wetlands and rivers). After all, the Donnellys have been swinging nets in and around Binghamton, New York, for more than half a century. None know the region better. And none other than Nick and Ailsa themselves could have been better hosts for the 2014 Northeast regional meeting of the DSA, held from 26–29 June. We even managed to find a few new county records.

About 50 people, from as far as Great Britain and as near as Binghamton, gathered under perfect skies to collect, photograph, watch, and learn about dragonflies. For whatever reason, this meeting amounted to a “great convergence” of seasoned and novice odonatists. More than usual, we DSA



Nick Donnelly (right) giving a field lecture. Photo by Bryan Pfeiffer.

members found ourselves guiding eager naturalists through their first experiences with dragonflies and damselflies. That's a good thing. Nick, ever the teacher, held forth on *Lanthus* (pygmy clubtails) or *Leucorrhinia* (whitefaces), or, of course, *Sympetrum* (meadowhawk) hybrids or the troubles with *Epitheca* (baskettails).

The 2014 regional meeting in Binghamton came 32 years after one of the earliest U.S. meetings, an informal gathering hosted by Nick and Ailsa on the weekend of 4 July 1982. That meeting drew 21 participants plus families, which amounted to a large portion of the odonatists in North America at the time. To that meeting came participants from as far away as Florida and Oklahoma. *Nannothemis bella* (Elfin Skimmer) and *Cordulegaster obliqua* (Arrowhead Spiketail) were added to the already large Broome County list during the 1982 meeting.

Our sites in 2014 included Chenango Valley State Park, Hawkins Pond Natural Area, Greenwood Park, and Marsh Pond. We also hit the road for Weirs Pond near Thompson, Pennsylvania, a lovely property of peatland and wooded stream owned by The Nature Conservancy. There we were joined by other local folks who learned a few things about dragonflies.

Indoors at the meeting, we heard from Erin White on the New York Dragonfly and Damselfly Survey (NYDDS) and from Kevin Hemeon on the identification of *Stylurus* (hanging clubtail) nymphs. Thanks as well goes to New York's own Paul Novak, who helped guide trips during the meeting. And, of course, we owe so much to our hosts. Nick

was meticulous about maps and site information. Ailsa did nearly everything else, including a ton of work for our picnic supper.

As for next year's Northeast regional meeting, there won't be one, but that's because the DSA 2015 Annual Meeting will be here in the Northeast, based in State College, Pennsylvania, at the end of June.

Here's a list from the meeting. An asterisk indicates a new Broom County record.

## Zygoptera (Damselflies)

### Calopterygidae (Jewelwings)

*Calopteryx aquabilis* (River Jewelwing)  
*C. maculata* (Ebony Jewelwing)

### Lestidae (Spreadwings)

*Lestes inaequalis* (Elegant Spreadwing)  
*L. rectangularis* (Slender Spreadwing)  
*L. vigilax* (Swamp Spreadwing)

### Coenagrionidae (Pond Damsels)

*Amphiagrion saucium* (Eastern Red Damsel)  
*Argia fumipennis violacea* (Violet Dancer)  
*A. moesta* (Powdered Dancer)  
*Chromagrion conditum* (Aurora Dancer)  
*Enallagma antennatum* (Rainbow Bluet)  
*E. aspersum* (Azure Bluet)  
*E. civile* (Familiar Bluet)  
*E. annexum* (Northern Bluet)  
*E. ebrium* (Marsh Bluet)  
*E. exsulans* (Stream Bluet)  
*E. geminatum* (Skimming Bluet)  
*E. hageni* (Hagen's Bluet)  
*E. signatum* (Orange Bluet)  
*E. traviatum* (Slender Bluet)  
*E. vesperum* (Vesper Bluet)  
*Ischnura posita* (Fragile Forktail)  
*I. verticalis* (Eastern Forktail)  
*Nehalennia irene* (Sedge Sprite)

## Anisoptera (Dragonflies)

### Aeshnidae (Darners)

*Aeshna* species (Mosaic Darners)  
*Anax junius* (Common Green Darner)  
*Epiaeschna heros* (Swamp Darner)

## Gomphidae (Clubtails)

*Arigomphus furcifer* (Lilypad Clubtail)  
*A. villosipes* (Unicorn Clubtail)  
*Dromogomphus spinosus* (Black-shouldered Spinyleg)  
*Gomphus borealis* (Beaverpond Clubtail)  
*G. descriptus*\* (Harpoon Clubtail)  
*G. exilis* (Lancet Clubtail)  
*G. lividus* (Ashy Clubtail)  
*G. spicatus* (Dusky Clubtail)  
*Lanthus parvulus* (Northern Pygmy Clubtail)  
*Stylogomphus albistylus* (Least Clubtail)

## Cordulegastridae (Spiketails)

*Cordulegaster diastatops* (Delta-spotted Spiketail)  
*C. maculata*\* (Twin-spotted Spiketail)  
*C. obliqua* (Arrowhead Spiketail)

## Macromiidae (Cruisers)

*Didymops transversa* (Stream Cruiser)

## Corduliidae (Emeralds)

*Cordulia shurtleffii* (American Emerald)  
*Dorocordulia libera* (Racket-tailed Emerald)  
*Epithecya cymosura* (Common Baskettail)  
*E. princeps* (Prince Baskettail)  
*Helocordulia uhleri* (Uhler's Sundragon)  
*Somatochlora walsbii*\* (Brush-tipped Emerald)

## Libellulidae (Skimmers)

*Celithemis elisa* (Calico Penant)  
*C. eponina* (Halloween Penant)  
*Erythemis simplicicollis* (Eastern Pondhawk)  
*Ladona julia* (Chalk-fronted Corporal)  
*Leucorrhinia frigida* (Frosted Whiteface)  
*L. hudsonica* (Hudsonian Whiteface)  
*L. intacta* (Dot-tailed Whiteface)  
*L. proxima* (Belted Whiteface)  
*Libellula cyanea* (Spangled Skimmer)  
*L. incesta* (Slaty Skimmer)  
*L. luctuosa* (Widow Skimmer)  
*L. pulchella* (Twelve-spotted Skimmer)  
*L. quadrimaculata* (Four-spotted Skimmer)  
*L. semifasciata* (Painted Skimmer)  
*Nannothemis bella* (Elfin Skimmer)  
*Pachydiplax longipennis* (Blue Dasher)  
*Perithemis tenera* (Eastern Amberwing)  
*Plathemis lydia* (Common Whitetail)  
*Sympetrum internum* (Cherry-faced Meadowhawk)  
*Tramea lacerata* (Black Saddlebags)







Attendees of the 2014 Northeast Regional DSA Meeting. Photo by Bryan Pfeiffer.

## Odonata of Black Moshannon State Park, Centre County, Pennsylvania

**Clark N. Shiffer**, 301 Farmstead Lane, State College, Pennsylvania, 16803 <tomboshif@yahoo.com>;  
**Betsy Leppo**, Western Pennsylvania Conservancy, Harrisburg Pennsylvania <bleppo@paconserve.org>; and  
**Harold B. White, III**, University of Delaware, Newark, Delaware, 19716 <halwhite@udel.edu>

### Abstract

Black Moshannon State Park includes a variety of freshwater wetlands that support a diversity of Odonata. It is situated 1900 feet (580 m) above sea level in central Pennsylvania. Since 1943, 96 species of Odonata have been observed within the park. We document the fauna that includes a number of species of state and regional conservation concern.

### Introduction

The 2015 annual Dragonfly Society of the Americas (DSA) meeting will be held in central Pennsylvania, where the local dragonfly fauna has been sampled frequently for more than 70 years. The first indications of its rich and diverse fauna emerged from a publication by George H. Beatty (Beatty, 1946) in which he reported collections at Bear Meadows and a few other locations near State College. In 1955, he moved to the State College area and lived there with his wife, Alice Ferguson Beatty, also an Odonata specialist. They and coauthors published 14 papers on Pennsylvania Odonata between 1968 and 1971, of which several relate to central Pennsylvania (Beatty, Beatty, and White, 1969a; Beatty, Beatty, and Shiffer, 1969b; Beatty and Beatty, 1971). While maintaining an interest in Odonata, the Beattys never published another paper on Odonata and devoted much of their time to botanical pursuits and photography. Alice passed away in 1987 and George died in 2004. The Beatty's large Odonata collection is now housed at Pennsylvania State University's Stuart W. Frost Entomological

Museum (Deans, 2013). Two of the authors (CNS and HBW) attribute their deep interest in Odonata to the Beattys, who cultivated that interest early on with frequent field trips and sharing of their extensive knowledge.

The 2015 DSA meeting will be a great opportunity to showcase and explore several rich Odonata habitats such as Bear Meadows (White, Beatty, and Beatty, 1968), Ten Acre Pond (White, 1963; Shiffer and White, 1995; 2014), and others where almost 100 species have been reported over the years. One of the lesser-known habitats is Black Moshannon State Park, the focus of this article, which will hopefully entice many to attend the 2015 DSA meeting.

### Black Moshannon State Park

Black Moshannon State Park (40.91°N, 78.06°W) in Rush Township, Centre County, Pennsylvania, is nine miles (15 km) east of Philipsburg and about 20 miles (32 km) northwest of State College. It contains a diverse complex of wetlands and supports a similarly diverse Odonata fauna. Black Moshannon Lake (250 A, 101 ha, elev. 1870 ft, 570 m), a long-standing impoundment about two miles (3 km) in greatest length, is the park's centerpiece. It is cradled in a broad valley atop the Allegheny Plateau and is almost surrounded by an extensive bog and heath complex. Numerous small streams, some with beaver ponds, feed the wetlands and lake that below the dam form Black Moshannon Creek, a medium-sized rocky stream flowing north in a narrow forested valley. Close by, the Allegheny Front drops 1300 feet (395 m) into Bald Eagle Valley in the Ridge and

Valley physiographic province. Ecologically, the area is more typical of boreal habitats in glaciated regions hundreds of miles to the north than to the habitats fairly close to the south and east. A map of the state park is available on line at <[http://www.mobilemaplets.com/thumbnails/2377\\_thumbnail-1024.jpg](http://www.mobilemaplets.com/thumbnails/2377_thumbnail-1024.jpg)>.

The park is within the larger Moshannon State Forest. The entire area was clearcut by and burned over by fires in the 1800s. To support the lumbering operations, a saw mill and dam were constructed on Black Moshannon Creek where it exits the shallow valley. This flooded many of the series of beaver dams to form the lake. During the 1930s, the dam was replaced by the Civilian Conservation Corps and again reconstructed the 1950s.

### Survey Methods

Due to the diverse, extensive, and often difficult-to-access wetlands in Black Moshannon State Park, Odonata surveys were frequently limited to certain areas and thus rarely sampled the full diversity of species present during a visit. For example, exploration of Black Moshannon Creek downstream from the lake would provide a reasonable sampling of stream species, but species present at the lake, bogs, beaver ponds, or small streams might not be seen. While recent surveys by CNS recorded all species seen, early records made by others only recorded specimens actually collected and preserved. Nevertheless, Odonata records on nearly 200 dates since 1943 reveal a tremendous diversity, even if common resident species such as *Ladona julia* (Chalk-fronted Corporal), *Calopteryx maculata* (Ebony Jewelwing), or *Ischnura verticalis* (Eastern Forktail) at unsampled habitats might have been overlooked in many years. Although the earliest and latest dates for Odonata range from early May to mid-October, most surveys (82%) occurred in June, July, and August, thus early and late dates for seasonal distributions presented in Table 2 may be truncated in some cases. All records used to construct Table 1 and 2 come from a Pennsylvania Odonata logbook maintained by CNS that was scanned and is available on-line through the Frost Museum Website (Shiffer, White, and Deans, 2014). Voucher specimens exist for virtually every species reported and are currently part of the Florida State Collection of Arthropods in Gainesville, Florida, where CNS's collection now resides.

### Decadal and Seasonal Distribution of Odonata at Black Moshannon State Park

Table 1 shows the number of years various species were observed at Black Moshannon by decade since the 1940s. Table 2 shows the seasonal distribution for each species and the number of survey dates by monthly quarter. While col-

lecting dates since 1943 provide a longitudinal perspective, the most thorough surveys have occurred in recent years. Thus, recent data provides a more robust indication of the Odonata fauna. Since 2000, 75 species have been recorded by CNS. Several of these are undoubtedly resident species that eluded detection in previous decades due to their low population numbers, localization to infrequently sampled habitats, or early or late seasonal occurrence. The incompleteness of the earlier surveys is evident by the common species that were not reported in many years. Nevertheless, these data do provide an indication of which species are resident and common, and those that may be resident but are uncommon. In the 69 years covered in Table 1, only 17 years do not have any records. It should be noted that the 2015 DSA meeting is scheduled for fourth week of June, when the largest number of species have been observed (67).

### Species of Conservation Interest in Pennsylvania

Nine species of special conservation concern with a rank of S1 or S2 for Pennsylvania have been reported from Black Moshannon State Park (Pennsylvania Natural Heritage Program, 2013). S1 indicates "Critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state. Typically 5 or fewer occurrences or very few remaining individuals or acres". S2 indicates "Imperiled in the state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state. Typically 6–20 occurrences or few remaining individuals or acres". State assessment ratings of S3, S4, and S5 indicate successively less vulnerability.

Note that state ranks are part of an iterative process to assess the health and status of species in the state. Records reported by odonate enthusiasts are a critical component of the assessment and ranking process. The ranks provided here were last updated in 2010. The Pennsylvania Natural Heritage Program is currently reviewing state ranks as part of a State Wildlife Action Plan update. Odonates are being assessed using NatureServe's rank calculator v3.1, in which the number of known populations carries less weight in determining rank. Range extent and threats are now the primary drivers of rank. Many species will see an increase of a half to one step (e.g., from S2 to S2S3 or S3) as a result of this new ranking approach. We anticipate that the new rankings will be posted on the Pennsylvania Natural Heritage Program website by early 2015 before the DSA meeting in June.

*Rhionaeschna mutata* (Spatterdock Darner) (S2): This species has been reported in eight different years and in almost every year recently when more intensive surveying was done. Usually only one or two were present. Thus, it is

likely a resident species with a small population. It flies over spatterdock patches at the lake in June and early July.

*Gomphus rogersi* (Sable Clubtail) (S2): Although this species has been reported only twice, its normal habitat of small sandy-bottomed woodland streams with gentle flow is often bypassed in surveys. It is likely a rare but resident species in the park.

*Libellula flavida* (Yellow-sided Skimmer) (S1): Two males of this southern species were seen in late June 2005. They were likely strays and not part of an established breeding population.

*Somatochlora incurvata* (Incurvate Emerald) (S1): For many years, this species was unknown in Pennsylvania. However, once its preferred bog heath habitat and later-season flight period were recognized, it was looked for and discovered in Clinton County (Shiffer, 1969) and subsequently in several other counties in north-central and northeastern Pennsylvania. It has been seen in three different years at Black Moshannon since its discovery there in 2002. It is undoubtedly a resident that flies in places that are hard to access.

*Gomphus descriptus* (Harpoon Clubtail) (S1S2): This stream species was recorded in five years before 1970, often commonly on Black Moshannon Creek in late May and June, but has not been reported since. Whether it is still a resident species is uncertain.

*Calopteryx aquabilis* (River Jewelwing) (S2): A single male was collected in 1954 by Stuart W. Frost. The species has not been seen since. While there may be populations further downstream on Black Moshannon Creek, finding it again would be a significant discovery.

*Gomphaeschna furcillata* (Harlequin Darner) (S2): This typical bog species is well known from Tamarack Bog to the north and Bear Meadows (White, Beatty, and Beatty, 1968) to the south, yet it has been reported only twice from Black Moshannon State Park where one might expect it to be a frequently-seen resident.

*Somatochlora forcipata* (Forcinate Emerald) (S2): Once this species was discovered as a resident in 2003, it was found in low numbers when looked for in late June and early July flying in sunny glades near the Moss-Hanne Trail.

*Somatochlora walshii* (Brush-tipped Emerald) (S2): This species is sufficiently common to be found when it is looked for in its preferred habitat of grassy wet meadows, often near beaver ponds

## Species that have not been found but could be present

There are several species that are not common in Pennsylvania but, based on their distribution in Pennsylvania and habitat preference, might be found in Black Moshannon State Park. Perhaps participants at the 2015 DSA meeting can document several and thereby top the 100 species mark for the park. Ten to look for include:

*Aeshna clepsydra* (Mottled Darner) (S2S3): This species is known from several counties in Pocono Mountains of northeastern Pennsylvania. CNS once observed a dragonfly following the shore of Black Moshannon Lake that appeared to be this species, but its identity was not confirmed.

*Lanthus parvulus* (Northern Pygmy Clubtail) (S3): This species is found on small cold-water streams in the Pennsylvania mountains, but it often goes unseen. Black Moshannon State Park is within its range and has the requisite habitats.

*Epithea spinigera* (Spiny Baskettail) (S1): A few records of this species exist in five northeastern counties of Pennsylvania. Black Moshannon State Park is near the southern range limit of this species.

*Somatochlora elongata* (Ski-tipped Emerald) (S2): It is hard to imagine that this species has not been found yet at Black Moshannon because there is plenty of suitable habitat and the species is known from other places in Centre County and adjacent counties.

*Leucorrhinia glacialis* (Crimson-ringed Whiteface) (S3S4): As with the previous species, this species would be expected to be present in Black Moshannon State Park due to its habitat preferences and known geographic range.

*Leucorrhinia proxima* (Belted Whiteface) (S2): There are relatively few Pennsylvania records for this species, but it has shown up at Ten Acre Pond (Shiffer and White, 2014) and Beaver Dam (CNS, unpublished record), and is known from several northern counties. The fact that it looks a lot like the more common *L. frigida* (Frosted Whiteface) might enable it to escape detection.

*Pantala flavescens* (Wandering Glider) (S5): This widespread migratory species can be expected to appear sometime at any habitat in Pennsylvania. It is surprising that it has not been reported at least once over a parking lot or field in Black Moshannon State Park.

*Tramea carolina* (Carolina Saddlebags) (S4S5): As with the previous species, *T. carolina* migrates and could appear

in the park. There are breeding populations within Centre County.


*Archilestes grandis* (Great Spreadwing) (S4): Twice there have been unconfirmed reports of this late-season damselfly along tributaries near the Mid-State Regional Airport on the west side of the park.

*Coenagrion resolutum* (Tiaga Bluet) (S1): This species is only known from five sites in Pennsylvania, but one is Ten Acre Pond in Centre County where it established a breeding colony for several years in the 1980s; it showed up there again briefly in 2001, which suggests there are source populations in the area. There are suitable habitats in Black Moshannon State Park where this species might show up.

### Future Study

As the above lists and Tables 1 and 2 indicate, there are a number of rare and interesting species in Black Moshannon State Park, and additional species that might well be found there. Other than the adjacent Mid-County Regional Airport, which may affect runoff and could degrade the habitat and water quality, the location of the park within the Moshannon State Forest provides some expectations for long-term habitat protection. We hope that this publication will make dragonfly enthusiasts aware of this important island of Odonata diversity and encourage continued study and monitoring. It will be among the habitats available for exploration during the next Annual DSA Meeting in June 2015 in State College, Pennsylvania.

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Table 1. Decadal distribution of Odonata at Black Moshannon State Park, Centre County, Pennsylvania

Species Scientific Name	Observation Interval							Tot Yrs
	1943 1949	1950 1959	1960 1969	1970 1979	1980 1989	1990 1999	2000 2010	
<i>Calopteryx aequabilis</i>	0	1	0	0	0	0	0	1
<i>Calopteryx amata</i>	0	0	3	2	2	0	1	8
<i>Calopteryx maculata</i>	0	0	2	2	3	3	9	19
<i>Lestes congener</i>	0	0	1	0	0	0	0	1
<i>Lestes dryas</i>	0	0	1	0	0	1	0	2
<i>Lestes eurinus</i>	0	0	0	0	0	1	0	1
<i>Lestes forcipatus</i>	0	0	1	0	0	0	1	2
<i>Lestes inaequalis</i>	1	1	1	0	1	1	2	7
<i>Lestes rectangularis</i>	1	1	2	1	1	1	6	13
<i>Lestes unguiculatus</i>	0	0	1	0	0	0	0	1
<i>Lestes vigilax</i>	0	0	1	1	0	2	4	8
<i>Amphiagrion saucium</i>	0	0	0	1	0	0	6	7
<i>Argia apicalis</i>	0	0	1	2	0	1	0	4
<i>Argia fumipennis violacea</i>	0	0	1	1	1	0	1	4
<i>Argia moesta</i>	0	0	1	0	0	0	2	3
<i>Chromagrion conditum</i>	0	2	5	2	2	1	7	19
<i>Enallagma antennatum</i>	0	0	1	1	0	0	1	3
<i>Enallagma aspersum</i>	0	0	1	2	2	1	0	6
<i>Enallagma basidens</i>	0	0	0	0	0	0	1	1
<i>Enallagma civile</i>	0	0	1	1	0	0	0	2
<i>Enallagma annexum</i>	0	0	1	1	0	0	0	2
<i>Enallagma divagans</i>	0	0	1	0	0	0	0	1
<i>Enallagma ebrium</i>	0	0	1	0	0	0	1	2
<i>Enallagma exsulans</i>	0	0	0	1	1	0	0	2
<i>Enallagma geminatum</i>	0	0	0	0	0	1	2	3
<i>Enallagma hageni</i>	0	2	4	2	2	2	10	22
<i>Enallagma signatum</i>	0	0	3	1	0	1	1	6
<i>Enallagma traviatum</i>	0	0	0	1	1	0	0	2
<i>Enallagma vesperum</i>	0	0	1	2	0	1	0	4
<i>Ischnura hastata</i>	0	0	0	0	0	0	2	2
<i>Ischnura posita</i>	0	0	1	0	0	0	2	3
<i>Ischnura verticalis</i>	3	3	3	3	3	3	8	26
<i>Nehalennia gracilis</i>	0	1	0	0	1	0	3	5
<i>Nehalennia irene</i>	0	1	3	0	3	1	6	14
<i>Aeshna canadensis</i>	2	1	1	3	2	1	4	14
<i>Aeshna tuberculifera</i>	0	0	0	1	1	0	4	6
<i>Aeshna umbrosa</i>	0	0	1	2	1	2	5	11
<i>Aeshna verticalis</i>	0	0	0	1	0	0	4	5
<i>Anax junius</i>	0	0	5	3	1	4	9	22
<i>Basiaeschna janata</i>	0	1	4	0	0	2	3	10
<i>Boyeria grafiana</i>	0	0	0	0	2	2	0	4
<i>Boyeria vinosa</i>	0	0	0	0	2	1	1	4
<i>Epiaeschna heros</i>	0	0	1	0	1	0	3	5
<i>Gomphaeschna furcillata</i>	0	0	0	1	0	0	1	2
<i>Rhionaeschna mutata</i>	0	0	0	1	0	1	6	8
<i>Arigomphus villosipes</i>	0	1	4	2	0	0	6	13
<i>Gomphus borealis</i>	0	1	4	2	1	2	7	17
<i>Gomphus descriptus</i>	0	2	3	0	0	0	0	5
<i>Gomphus exilis</i>	0	1	3	2	1	1	4	12
<i>Gomphus lividus</i>	0	0	4	1	0	2	2	9
<i>Gomphus rogersi</i>	0	0	1	0	0	0	1	2
<i>Gomphus spicatus</i>	0	2	3	4	1	1	5	16
<i>Hagenius brevistylus</i>	0	1	1	2	0	0	0	4
<i>Lanthus vernalis</i>	0	0	1	0	0	0	0	1

Table 1, continued. Decadal distribution of Odonata at Black Moshannon State Park, Centre County, Pennsylvania

Species Scientific Name	Observation Interval							
	1943 1949	1950 1959	1960 1969	1970 1979	1980 1989	1990 1999	2000 2010	Tot Yrs
<i>Ophiogomphus mainensis</i>	0	0	0	0	2	1	1	4
<i>Stylogomphus albistylus</i>	0	0	2	1	0	0	1	4
<i>Cordulegaster diastatops</i>	0	0	1	2	2	4	9	18
<i>Cordulegaster maculata</i>	0	0	1	0	1	0	4	6
<i>Cordulegaster obliqua</i>	0	0	0	0	1	2	7	10
<i>Didymops transversa</i>	1	1	1	0	0	0	0	3
<i>Macromia illinoiensis</i>	0	0	0	1	0	0	0	1
<i>Cordulia shurtleffi</i>	0	0	3	0	0	0	5	8
<i>Dorocordulia libera</i>	3	3	6	2	2	3	9	28
<i>Epitheca canis</i>	0	1	2	3	0	2	4	12
<i>Epitheca cynosura</i>	1	4	4	2	2	3	9	25
<i>Epitheca princeps</i>	0	0	0	0	0	1	2	3
<i>Helocordulia uhleri</i>	0	0	4	2	0	0	1	7
<i>Somatochlora forcipata</i>	0	0	0	0	0	0	4	4
<i>Somatochlora incurvata</i>	0	0	0	0	0	0	3	3
<i>Somatochlora tenebrosa</i>	0	0	3	3	2	2	9	19
<i>Somatochlora walshii</i>	0	0	0	3	0	1	7	11
<i>Celithemis elisa</i>	0	0	0	0	0	0	2	2
<i>Celithemis eponina</i>	0	0	0	0	0	0	1	1
<i>Erythemis simplicicollis</i>	0	0	0	0	0	0	4	4
<i>Ladona julia</i>	0	4	5	5	1	4	9	28
<i>Leucorrhinia frigida</i>	0	2	4	1	2	2	8	19
<i>Leucorrhinia hudsonica</i>	0	0	2	0	0	0	3	5
<i>Leucorrhinia intacta</i>	0	3	1	2	1	3	8	18
<i>Libellula axilena</i>	0	0	0	0	0	0	1	1
<i>Libellula cyanea</i>	0	0	0	0	0	0	4	4
<i>Libellula flavida</i>	0	0	0	0	0	0	1	1
<i>Libellula luctuosa</i>	0	0	0	0	0	2	3	5
<i>Libellula pulchella</i>	0	0	1	2	0	1	8	12
<i>Libellula quadrimaculata</i>	0	0	3	2	1	2	9	17
<i>Libellula semifasciata</i>	1	0	2	1	0	1	2	7
<i>Libellula vibrans</i>	0	0	0	0	0	0	6	6
<i>Plathemis lydia</i>	1	0	1	1	0	2	6	11
<i>Pachydiplax longipennis</i>	0	0	0	0	0	0	1	1
<i>Pantala flavescens</i>	0	0	0	0	0	0	1	1
<i>Pantala hymenaea</i>	2	0	1	1	0	3	0	7
<i>Perithemis tenera</i>	0	1	3	3	1	2	9	19
<i>Sympetrum janeae</i>	0	0	0	0	0	1	8	9
<i>Sympetrum obtrusum</i>	1	1	0	0	1	0	0	3
<i>Sympetrum semicinctum</i>	0	0	0	2	1	1	6	10
<i>Sympetrum vicinum</i>	2	4	0	0	0	2	5	13
<i>Tramea lacerata</i>	0	0	0	0	0	0	4	4
<b>Total Species</b>	12	26	59	50	37	48	75	96
<b>Number of visits during interval</b>	6	9	23	23	10	28	94	193

Table 2. Seasonal distribution of Odonata at Black Moshannon State Park, Centre County, Pennsylvania.

Species Scientific Name	Seasonal Distribution by Monthly Quarters																				Tot Qtrs	Early - Late Dates		
	May				June				July				August				September						Oct	
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV			I	II
<i>Calopteryx aequabilis</i>							X															1	June 22	
<i>Calopteryx amata</i>					X	X	X	X	X	X	X	X											7	June 8 - July 29
<i>Calopteryx maculata</i>					X	X	X	X	X	X	X	X	X	X									10	June 8 - August 12
<i>Lestes congener</i>																					X		1	September 13
<i>Lestes dryas</i>										X		X											2	July 15 - July 31
<i>Lestes eurinus</i>								X															1	June 25
<i>Lestes forcipatus</i>												X				X							2	July 31 - August 17
<i>Lestes inaequalis</i>					X	X	X				X	X	X										6	June 11 - August 4
<i>Lestes rectangularis</i>					X		X			X	X	X	X	X	X	X			X				10	June 15 - September 10
<i>Lestes unguiculatus</i>																					X		1	July 31
<i>Lestes vigilax</i>						X		X			X	X	X	X							X		7	June 11 - September 8
<i>Amphiagrion saucium</i>				X		X	X	X	X	X					X								7	May 30 - August 15
<i>Argia apicalis</i>										X	X		X										3	July 11 - August 8
<i>Argia fumipennis violacea</i>								X	X		X		X										4	June 25 - August 1
<i>Argia moesta</i>						X		X															2	June 11 - June 30
<i>Chromagrion conditum</i>	X			X	X	X	X	X	X	X	X												8	May 15 - July 22
<i>Enallagma antennatum</i>								X															1	June 25 - June 30
<i>Enallagma aspersum</i>								X			X	X	X										4	June 24 - August 1
<i>Enallagma basidens</i>					X																		1	June 11
<i>Enallagma civile</i>												X								X			2	July 24 - September 8
<i>Enallagma annexum</i>								X															1	June 24 - June 29
<i>Enallagma divagans</i>								X															1	June 25
<i>Enallagma ebrium</i>						X	X																2	June 19 - June 27
<i>Enallagma exsulans</i>								X		X			X										3	June 29 - August 1
<i>Enallagma geminatum</i>								X	X		X									X			4	June 27 - August 25
<i>Enallagma hageni</i>					X	X	X	X	X	X	X	X	X		X	X							10	June 8 - August 25
<i>Enallagma signatum</i>					X		X			X										X	X		5	June 11 - September 13
<i>Enallagma traviatum</i>								X		X													2	June 24 - July 18
<i>Enallagma vesperum</i>								X	X	X	X	X		X					X				6	June 24 - September 8
<i>Ischnura hastata</i>						X				X									X	X	X		5	June 12 - September 11
<i>Ischnura posita</i>						X		X				X											3	June 11 - July 30
<i>Ischnura verticalis</i>	X			X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		14	May 15 - September 13
<i>Nehalennia gracilis</i>							X	X		X	X		X	X									6	June 20 - August 15
<i>Nehalennia irene</i>					X	X	X	X	X	X	X	X											8	June 8 - July 30
<i>Aeshna canadensis</i>												X	X	X	X	X	X	X	X	X			9	July 29 - September 30
<i>Aeshna tuberculifera</i>												X		X	X	X	X	X	X				7	August 1 - September 30
<i>Aeshna umbrosa</i>							X					X		X	X	X	X	X	X		X		9	June 20 - October 12
<i>Aeshna verticalis</i>										X				X	X	X	X	X	X	X		X	8	July 10 - October 1
<i>Anax junius</i>	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	17	May 6 - October 1
<i>Basiaeschna janata</i>				X	X	X	X			X													5	May 28 - July 11
<i>Boyeria grafiana</i>													X	X									2	August 1 - August 12
<i>Boyeria vinosa</i>											X	X	X					X					4	July 29 - September 4
<i>Epiaeschna heros</i>						X		X					X		X								4	June 9 - August 20
<i>Gomphaeschna furcillata</i>								X	X														2	June 20 - June 24
<i>Rhionaeschna mutata</i>						X	X	X	X		X												5	June 11 - July 26
<i>Arigomphus villosipes</i>						X	X	X	X	X	X	X			X								8	June 11 - August 20
<i>Gomphus borealis</i>					X	X	X	X	X		X												7	May 30 - July 25
<i>Gomphus descriptus</i>					X		X	X	X														4	May 28 - June 24
<i>Gomphus exilis</i>						X	X	X	X		X												5	June 9 - July 13
<i>Gomphus lividus</i>				X	X	X	X	X	X														6	May 20 - June 25
<i>Gomphus rogersi</i>								X	X														2	June 23 - June 30
<i>Gomphus spicatus</i>				X		X	X	X	X	X	X												7	May 20 - July 17
<i>Hagenius brevistylus</i>								X	X	X													3	June 24 - July 27
<i>Lanthus vernalis</i>						X	X	X		X													4	June 15 - July 14

Table 2. Seasonal distribution of Odonata at Black Moshannon State Park, Centre County, Pennsylvania.

Species Scientific Name	Seasonal Distribution by Monthly Quarters																						Tot	Early - Late Dates
	May				June				July				August				September				Oct			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II		
<i>Ophiogomphus mainensis</i>						X																	2	June 10 - August 4
<i>Stylogomphus albistylus</i>						X		X															2	June 11 - June 30
<i>Cordulegaster diastatops</i>			X	X	X	X	X	X	X	X	X	X	X										11	May 20 - August 15
<i>Cordulegaster maculata</i>				X					X	X	X												4	May 28 - July 6
<i>Cordulegaster obliqua</i>					X	X	X	X	X	X													6	June 8 - July 14
<i>Didymops transversa</i>						X		X	X														3	June 9 - July 4
<i>Macromia illinoensis</i>									X														1	June 29
<i>Cordulia shurtleffi</i>					X	X	X	X		X	X												6	June 8 - July 22
<i>Dorocordulia libera</i>				X	X	X	X	X	X	X	X	X	X										10	May 30 - August 7
<i>Epitheca canis</i>	X	X	X	X	X	X	X	X	X														6	May 7 - July 3
<i>Epitheca cynosura</i>			X		X	X	X	X	X	X	X	X											9	May 20 - July 30
<i>Epitheca princeps</i>								X									X						2	June 27 - Aug 19
<i>Helocordulia uhleri</i>				X		X		X															3	May 28 - June 30
<i>Somatochlora forcipata</i>						X	X	X	X														4	June 19 - July 10
<i>Somatochlora incurvata</i>										X				X	X	X	X	X	X				7	July 17 - September 17
<i>Somatochlora tenebrosa</i>						X	X	X	X	X	X	X	X	X	X	X	X	X	X				14	June 15 - September 17
<i>Somatochlora walshii</i>						X	X	X	X	X	X	X		X	X	X	X						11	June 15 - September 8
<i>Celithemis elisa</i>						X												X					2	June 15 - September 4
<i>Celithemis eponina</i>													X	X									2	August 3 - August 15
<i>Erythemis simplicicollis</i>									X		X	X					X						4	June 23 - August 27
<i>Ladona julia</i>				X	X	X	X	X	X	X	X	X	X										10	May 28 - August 4
<i>Leucorrhinia frigida</i>						X	X	X	X	X	X	X	X	X	X	X							10	June 11 - August 25
<i>Leucorrhinia hudsonica</i>						X	X	X	X	X													5	June 11 - July 13
<i>Leucorrhinia intacta</i>					X	X	X	X	X	X	X		X	X									9	June 8 - August 9
<i>Libellula axilena</i>						X				X													2	June 15 - July 21
<i>Libellula cyanea</i>						X		X		X				X									4	June 15 - August 15
<i>Libellula flavida</i>								X															1	June 25
<i>Libellula luctuosa</i>						X	X	X	X	X	X	X											6	June 15 - August 4
<i>Libellula pulchella</i>				X		X	X	X	X	X	X	X	X	X	X	X	X	X					12	May 30 - September 11
<i>Libellula quadrimaculata</i>			X	X		X	X	X	X	X	X		X										9	May 20 - August 4
<i>Libellula semifasciata</i>						X	X	X	X	X	X	X		X	X								10	June 5 - August 23
<i>Libellula vibrans</i>						X																	1	June 15
<i>Plathemis lydia</i>				X	X	X	X	X	X	X	X		X	X	X	X		X					13	May 25 - September 17
<i>Pachydiplax longipennis</i>						X	X	X	X	X	X	X	X	X	X	X	X	X					12	June 11 - September 4
<i>Pantala flavescens</i>																					X		1	September 5
<i>Pantala hymenaea</i>										X													1	July 13
<i>Perithemis tenera</i>								X	X	X	X	X	X	X									6	June 30 - August 22
<i>Sympetrum janaea</i>					X		X	X	X	X	X	X	X	X	X	X	X	X	X				11	June 15 - September 17
<i>Sympetrum obtrusum</i>								X			X	X						X					4	July 6 - September 10
<i>Sympetrum semicinctum</i>											X	X	X	X	X	X	X	X	X				8	July 29 - September 17
<i>Sympetrum vicinum</i>										X		X		X	X	X	X	X	X				8	July 21 - September 17
<i>Tramea lacerata</i>								X	X							X	X	X	X		X		7	June 30 - October 1
<b>Total Species</b>	2	3	5	18	19	54	42	67	40	41	42	33	35	24	25	22	23	18	10	4	3	1	96	May 7 - October 12
<b>Number of visits during interval</b>	2	1	3	3	6	18	21	24	14	12	11	16	13	7	9	8	10	6	4	3	1	1	193	

**Common Names of Species**

- Calopteryx aquabilis*
- C. amata*
- C. maculata*
- Lestes congener*
- L. dryas*
- L. eurinus*
- L. forcipatus*
- L. inaequalis*
- L. rectangularis*
- L. unguiculatus*
- L. vigilax*
- Amphiagrion saucium*
- Argia apicalis*
- A. fumipennis violacea*
- A. moesta*
- Chromagrion conditum*

- River Jewelwing
- Superb Jewelwing
- Ebony Jewelwing
- Spotted Spreadwing
- Emerald Spreadwing
- Amber-winged Spreadwing
- Sweetflag Spreadwing
- Elegant Spreadwing
- Slender Spreadwing
- Lyre-tipped Spreadwing
- Swamp Spreadwing
- Eastern Red damsel
- Blue-fronted Dancer
- Violet Dancer
- Powdered Dancer
- Aurora Damsel

- Enallagma antennatum*
- E. aspersum*
- E. basidens*
- E. civile*
- E. annexum*
- E. divagans*
- E. ebrium*
- E. exsulans*
- E. geminatum*
- E. hageni*
- E. signatum*
- E. triviatum*
- E. vesperum*
- Ischnura bastata*
- I. posita*
- I. verticalis*
- Nehalennia gracilis*
- N. irene*

- Rainbow Bluet
- Azure Bluet
- Double-striped Bluet
- Familiar Bluet
- Northern Bluet
- Turquoise Bluet
- Marsh Bluet
- Stream Bluet
- Skimming Bluet
- Hagen's Bluet
- Orange Bluet
- Slender Bluet
- Vesper Bluet
- Citrine Forktail
- Fragile Forktail
- Eastern Forktail
- Sphagnum Sprite
- Sedge Sprite



## Common Names of Species, continued

<i>Aeshna canadensis</i>	Canada Darner	<i>E. cynosura</i>	Common Baskettail
<i>A. tuberculifera</i>	Black-tipped Darner	<i>E. princeps</i>	Prince Baskettail
<i>A. umbrosa</i>	Shadow Darner	<i>Helocordulia ubleri</i>	Uhler's Sanddragon
<i>A. verticalis</i>	Green-striped Darner	<i>Somatochlora forcipata</i>	Forcipate Emerald
<i>Anax junius</i>	Common Green Darner	<i>S. incurvata</i>	Incurvate Emerald
<i>Basiaeschna janata</i>	Springtime Darner	<i>S. tenebrosa</i>	Clamp-tipped Emerald
<i>Boyeria grafiana</i>	Ocellated Darner	<i>S. walsbii</i>	Brush-tipped Emerald
<i>B. vinosa</i>	Fawn Darner	<i>Celithemis elisa</i>	Calico Pennant
<i>Epiaeschna heros</i>	Swamp Darner	<i>C. eponina</i>	Halloween Pennant
<i>Gomphaeschna furcillata</i>	Harlequin Darner	<i>Erythemis simplicicollis</i>	Eastern Pondhawk
<i>Rhionaeschna mutata</i>	Spatterdock Darner	<i>Ladona julia</i>	Chalk-fronted Corporal
<i>Arigomphus villosipes</i>	Unicorn Clubtail	<i>Leucorrhinia frigida</i>	Frosted Whiteface
<i>Gomphus borealis</i>	Beaverpond Clubtail	<i>L. hudsonica</i>	Hudsonian Whiteface
<i>G. descriptus</i>	Harpoon Clubtail	<i>L. intacta</i>	Dot-tailed Whiteface
<i>G. exilis</i>	Lancet Clubtail	<i>Libellula axilena</i>	Bar-winged Skimmer
<i>G. lividus</i>	Ashy Clubtail	<i>L. cyanea</i>	Spangled Skimmer
<i>G. rogersi</i>	Sable Clubtail	<i>L. flavida</i>	Yellow-sided Skimmer
<i>G. spicatus</i>	Dusky Clubtail	<i>L. luctuosa</i>	Widow Skimmer
<i>Hagenius brevistylus</i>	Dragonhunter	<i>L. pulchella</i>	Twelve-spotted Skimmer
<i>Lanthus vernalis</i>	Southern Pygmy Clubtail	<i>L. quadrimaculata</i>	Four-spotted Skimmer
<i>Ophiogomphus mainensis</i>	Maine Snaketail	<i>L. semifasciata</i>	Painted Skimmer
<i>Stylogomphus albistylus</i>	Eastern Least Clubtail	<i>L. vibrans</i>	Great Blue Skimmer
<i>Cordulegaster diastatops</i>	Delta-spotted Spiketail	<i>Platthemis lydia</i>	Common Whitetail
<i>C. maculata</i>	Twin-spotted Spiketail	<i>Pachydiplax longipennis</i>	Blue Dasher
<i>C. obliqua</i>	Arrowhead Spiketail	<i>Pantala flavescens</i>	Wandering Glider
<i>Didymops transversa</i>	Stream Cruiser	<i>Pantala hymenaea</i>	Spot-winged Glider
<i>Macromia illinoiensis</i>	Swift River Cruiser	<i>Perithemis tenera</i>	Eastern Amberwing
<i>Cordulia shurtleffii</i>	American Emerald	<i>Sympetrum janeae (internum)</i>	Cherry-faced Meadowhawk
<i>Dorocordulia libera</i>	Racket-tailed Emerald	<i>Sympetrum obtrusum</i>	White-faced Meadowhawk
<i>Epitheca canis</i>	Beaverpond Baskettail	<i>S. semicinctum</i>	Band-winged Meadowhawk
		<i>S. vicinum</i>	Autumn Meadowhawk
		<i>Tramea lacerata</i>	Black Saddlebags

## Register Now for the 2015 DSA Central American Regional Meeting!

DSA will host its first-ever Central American Regional Meeting in Costa Rica from 31 May–9 June 2015. This is an eight day/nine night meeting in the land of Pseudostigmatidae, resplendent quetzels, and poison dart frogs. The meeting will involve field excursions through the Organization of Tropical Studies (OTS) at two of their field stations in different ecoregions: La Selva, in the Caribbean Lowlands of northern Costa Rica in an area of tropical and premontane wet forest; and Palo Verde, an area in northwestern Costa Rica with deciduous dry forest, and freshwater marshes and wetlands bordering the Tempisque River. Dennis Paulson will be our keynote speaker and main guide, and Ken Tennessen will also present and lead guided field excursions. Bill Haber will also be joining us for the La Selva portion of the trip. Don't miss a rare opportunity to learn from an A-team of odonatologists in a gorgeous tropical setting in one of the most biodiverse counties on Earth!

Seats are limited, so don't delay. Full details regarding the daily itinerary, costs, registration, and more can be found on the meeting web site at <<https://sites.google.com/site/2015dsacostarica/>>. You can also contact Marla Garrison at <[mgarrison@mchenry.edu](mailto:mgarrison@mchenry.edu)> with additional questions.

Registration must be completed by 1 February 2015, and deposits must be received by mid-February. Spaces are filling up fast, so be sure to check out the details soon!

# Extended Opportunities for Collecting Anisoptera Exuviae Late in the Season Along Rivers

**Robert B. DuBois**, Department of Natural Resources, Bureau of Natural Heritage Conservation, 1701 N. 4th Street, Superior, Wisconsin, 54880 <robert.dubois@wisconsin.gov>; **William A. Smith**, Department of Natural Resources, Bureau of Natural Heritage Conservation, P.O. Box 7921, Superior, Wisconsin, 53707 (retired) <smithroo.smith@gmail.com>; and **Matthew S. Berg**, Grantsburg High School, 480 East James Avenue, Grantsburg, Wisconsin, 54840 <mberg@grantsburg.k12.wi.us>

## Introduction

Odonata exuviae are extremely valuable indicators of species' presence because they indicate a breeding site with certainty and demonstrate that the species was present at all stages of the life cycle (Oertli, 2008; Aliberti Lubertazzi and Ginsberg, 2009). According to Oertli (2008), the presence of exuviae on the shore is the best indicator of the association of a species with a water body. Further, for autecological studies to determine the status and continuity of breeding surveys, exuvial surveys were determined by Corbet (1999, p. 13) to be one of two quantitative methods that were disproportionately valuable. Collections of exuviae have provided useful documentation of the presence, abundance, and habitat use of a number of river species that are rarely seen near emergence areas (e. g. Orr, 2006, cited by Aliberti Lubertazzi and Ginsberg, 2009). Some river species are hard to find as adults because of their crepuscular habits (e.g. species of *Neurocordulia* [Shadowdragons]). Others feed and perch in the forest canopy and tend to fly away from shore when at water (e.g. *Stylurus notatus* [Evasive Clubtail] and *Ophiogomphus howei* [Pygmy Snaketail]). But in these and many other cases, the presence of their exuviae may show them to be regionally widespread. Additionally, exuvial surveys have the advantages of minimizing sampling effort and having low impacts on local populations because live individuals are not removed or disturbed (Aliberti Lubertazzi and Ginsberg, 2009).

Unfortunately, the window of opportunity for collecting exuviae of many species along rivers is narrow because of the prevalence of "spring" species (Corbet, 1954), which typically have short, synchronized emergence periods (see Johnson, 1962 for an extreme example), and because exuviae are quickly blown away by wind, knocked off their emergence perches by rain and high water, and they eventually decompose. Persistence of Anisoptera exuviae on vegetation and rock substrates in wetlands is known to decline exponentially; they disappear rapidly during the first few weeks post-emergence but more slowly after that (Aliberti Lubertazzi and Ginsberg, 2009). Our experience (RBD, unpublished) has been that numbers of exuviae along rivers decline even more rapidly than reported for wetlands, typically becoming hard to find by 4–6 weeks post-emergence,

even in areas where they were extremely abundant. Thus, the short time frame for optimal sampling of exuviae can place stresses on valuable field time. Uncertainty about optimal times for collections due to interannual variation in the timing of emergence cues can further complicate the scheduling of riverine exuvial surveys for spring species.

However, under certain favorable conditions where sheltered from wind, rain, and high water, and during relatively dry summers, some exuviae will persist much longer than average, which can extend the window of opportunity for collecting exuviae for some applications. Catling (2003) noted that exuviae persisted under bridges longer than elsewhere because they were protected from wind and rain and were often secured in place by spider webs. Areas that provided some shelter for exuviae of *Macromia splendens* included small cavities under river banks, under ferns, and on tree trunks (Cordero Rivera, Utzeri, and Santolamazza Carbone, 1999). In this note we describe our experiences with late-season collections of Anisoptera exuviae along rivers in Wisconsin when searches were focused in the washed root zones of undercut banks and in other sheltered areas.

## ***Cordulegaster* (Spiketail) Exuviae May be Prime Candidates for Extended Persistence**

The tendency for undercut banks to hold exuviae for extended periods was made fully apparent to RBD when on 4 September 2001 he found a *Cordulegaster maculata* (Twinspotted Spiketail) exuvia in good condition deep among the tangled washed roots of an undercut bank on the Black River in Douglas County. This exuvia of a spring-emerging species in northern Wisconsin had likely been in place for about three months. *C. maculata* exuviae appear to be likely candidates for lengthy persistence times because they are large, have relatively thick exoskeletons, and often emerge in the well-sheltered washed root zones of undercut banks.

## **Exuviae Trump Trout Fishing**

On 4 September 2004, while fishing the Bois Brule River in Douglas County about 4 miles north of the Town of Brule (46.6122° N, 91.5830° W), RBD was surprised to find quite

a few exuviae of *Ophiogomphus colubrinus* (Boreal Snaketail) along the banks (his field notes mention that he “took four from a 1 ft. square area”). *O. colubrinus* usually emerges from the Bois Brule River during the 2nd and 3rd weeks of June (RBD, unpublished data). The area where these were found was sheltered by a thick canopy of conifers, and the summer of 2004 had been unusually dry in this region with no major rainfall events. The Bois Brule River is a 76-km-long, spring-fed trout stream in northwestern Wisconsin that is known for its relatively stable flow regime compared to other streams in the region (DuBois and Pratt, 1994).

His curiosity piqued, RBD returned to this section of the Bois Brule River in mid-October 2004 (several trips from the 12–18 October) for a more systematic look at exuvial persistence on a stable-flow river during a low-water year. This was 3–4 months after the anticipated emergence periods of *O. colubrinus* and *C. maculata* (hereafter referred to as the target species) in this river. An 850 m reach of river (length estimated from aerial photographs) was selected for collecting exuviae. After collecting along several hundred meters of shoreline in this reach, exuviae of both target species were found, but only in the washed-root areas of undercut banks. Exuviae of *Stylurus scudderii* (Zebra Clubtail) and *Boyeria vinosa* (Fawn Darner) were also found in undercut bank areas and in other areas as well, but these species emerge after mid-summer at this latitude so were of less interest in this study. After this initial period of searching, all further searches targeted only undercut banks. Seven undercut bank areas were found after walking the shoreline of the entire 850-m reach. These areas were small (1.5–4.5 m in length), isolated, and uncommon, but were easily spotted from the opposite bank while walking each shoreline. Undercut bank areas totaled 20 m of the 1700 m of bank length in the selected reach (includes both banks), thus comprising about 1% of the total length of shoreline. Between one and five target exuviae were found in each of the seven undercut bank areas. A total of 25 *O. colubrinus* and two *C. maculata* exuviae were collected from these areas, which averaged about one target exuvia for every 0.75 m of undercut bank shoreline searched.

Because rising water levels seem to be the most likely causative agents for dislodging exuviae from undercut banks (more so than the impacts of wind or rain drops), we examined the daily discharge data for the mid-section of the Bois Brule River collected by the U. S. Geological Survey (USGS; <[http://waterdata.usgs.gov/nwis/uv/?site\\_no=04025500&agency\\_cd=USGS](http://waterdata.usgs.gov/nwis/uv/?site_no=04025500&agency_cd=USGS)>). This was a 65-year dataset that ran from 1943–2012 at the time of this analysis (with four years of missing data). The time frame for considering river levels pertinent to this study ran from 10 June, the earliest date when the spring species typically first start to emerge from this river (RBD, unpublished data),



Cluster of exuviae of *Ophiogomphus smithi* (Sioux Snaketail) on a root from an undercut bank of the Eau Claire River.

through mid-October. From the USGS discharge data we calculated that during this time frame in 2004, the river level never exceeded 15 cm above base flow and was less than 10 cm above base flow for more than 90% of the time frame. Mean vertical height above water traveled by *O. colubrinus* nymphs prior to emergence has not been measured, to our knowledge. However, Cordero (1995) reported that the mean vertical height above water on vegetation of exuviae of *Gomphus pulchellus* and *Onychogomphus uncutus* averaged about 18 cm for both species. Tonczyk (2007) reported a considerably higher mean vertical height (77 cm) for exuviae of the congeneric *Ophiogomphus cecilia*. If the mean vertical height of exuviae of *O. colubrinus* is at least as high as the lower end of this range, then the water level in the Bois Brule River in 2004 did not reach the mean vertical height of *O. colubrinus* exuviae at any time during the 10 June through mid-October time frame. Additionally, exuviae along the Bois Brule River were further above the water level during most of the time they persisted than they were at emergence because river levels in northern regions of the Midwest are typically above base flow when spring species are emerging, then recede afterwards, which was the case in 2004 on this river. Expanding this analysis to other years, we calculated that during only about half of the years of water discharge data collection did the level of the Bois Brule River rise high enough to knock most of the *O. colubrinus* exuviae off their emergence perches at any time during the 10 June to mid-October time frames.

### St. Croix River *Neurocordulia* (Shadowdragon) Saga

In late October 2004, we received word that an electrofishing boat crew on the St. Croix River (Polk County; 45.4072° N, 92.6473° W) had retained a number of burbot (*Lota lota*) in a holding tank, some of which had regurgitated their stomach contents that contained parts of dragonfly nymphs. An examination of this material, though fragmentary, revealed that eight part-grown nymphs of *Neurocordulia* had been

consumed. However, these nymphs had very long lateral spines on abdominal segment 9 that extended well beyond the tips of the paraprocts and therefore keyed to *N. obsoleta* (Umbler Shadowdragon), which was not known to occur in Wisconsin. Not realizing at the time that nymphs of *Neurocordulia* may show allometric growth of the lateral spines during ontogeny (but that's a topic for another note), we were excited about the possibility of finding what would have been a new state record species. We wanted to confirm this find with more mature and intact specimens. Recalling the recent finding of extended persistence of exuviae on the Bois Brule River, along with the extensive experience of WAS in collecting *Neurocordulia* exuviae late in the season (including a few exuviae that appeared to be at least one year old), and not wanting to wait for spring to document a new state record species, we decided to look right away for *Neurocordulia* exuviae along the St. Croix River near the spot where the burbot were collected.

On 4 November, MSB, RBD, and six Grantsburg high school students spent several hours searching for exuviae along that shoreline of the St. Croix River. The shoreline there was rocky, with steep cliff faces nearby and no undercut banks in the area. We did not find any exuviae of *N. obsoleta*, but we did find exuviae of 22 *N. yamaskanensis* (Stygian Shadowdragon), one *N. molesta* (Smoky Shadowdragon), and three *Gomphus vastus* (Cobra Clubtail), all from partially sheltered nooks and crannies among the rocks and sparse vegetation. Some of the exuviae were held in place in rocky crevices by spider webs. Others had been washed into slight depressions among the rocks containing leaf packs. Since no exuviae of *N. obsoleta* were found, we began considering other explanations for our burbot stomach content dilemma, which led to a rearing study of early instar nymphs of *N. yamaskanensis* to measure lateral spine growth during ontogeny.

### Overwintered Exuviae

Winter in Wisconsin is a rather serious matter, especially for persisting exuviae which may be exposed to gale force winds without protection from leafy vegetation, or may lie buried under the crushing weight of multiple feet of snow for months. When winter finally breaks, rivers often swell out of their banks with snow-melt runoff while jagged ice flows scour the banks. Nonetheless, some exuviae do appear to persist through the winter here. We say "appear" because we have generally begun our searches for exuviae only shortly before the emergence of target species is predicted to start (so as not to miss the onset). Exceptionally early searches have sometimes revealed a few well-weathered exuviae, often with tattered or missing body parts, that strongly suggested they had overwintered, although very early emergence of a few precocious individuals

could not always be ruled out. Weathered exuviae found well before any known emergence of that species in the year they were collected (thus likely overwintered) include three *Ophiogomphus rupinsulensis* (Rusty Snaketail), one of which was found under a bridge; two *Hagenius brevistylus* (Dragonhunter); several *Neurocordulia* as noted above; and one *Boyeria vinosa* (Fawn Darner) from under a bridge.

### Conclusions


Our sampling experiences demonstrate that numbers of Anisoptera exuviae can sometimes be found at least three months after emergence by targeting searches in a variety of sheltered areas along rivers. The most promising sheltered sites to search for extended-season exuviae are under bridges, under thick canopies of riparian trees and smaller plants, and in the cavities beneath undercut banks that often contain tangled masses of washed roots. Additionally, on one occasion over two dozen older exuviae (mostly *Neurocordulia*) were found in rocky crevices where they were held in place by spider webs and in depressions among rocks where they were scattered within leaf packs. Searching for late-season riverine exuviae is most likely to be successful during low-water years and along rivers with relatively stable flow regimes, but success is not necessarily limited to those conditions. It is sometimes possible to find enough late-season exuviae to help answer relevant questions about species occurrence. However, late-season exuviae may not be useful for quantitative analyses because of their irregular presence in limited areas and should be considered with much caution in determinations of species absence.

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## The Oklahoma Odonata Project: Progress and Trends

Michael A. Patten and Brenda D. Smith-Patten, Oklahoma Biological Survey, University of Oklahoma, Norman, Oklahoma, 73019 <argia@ou.edu>

As the 2014 odonate season comes to a close, we have completed the sixth year of statewide surveys designed to plug gaps in our knowledge about the status, distribution, and ecology of Odonata across the state of Oklahoma. We launched this project, which was funded by the Oklahoma Biological Survey and Oklahoma Department of Wildlife Conservation, in 2009. In recent years our efforts have resulted in a number of publications (e.g., see recent issues of ARGIA; Patten and Smith-Patten, 2013a), including the first review of odonate species of conservation concern for any American state (Patten and Smith-Patten, 2013b). Herein we report progress and highlight major findings as well as trends we have noted.

### County Lists

We initiated the project by compiling records taken from field notes, archived photographs, publications (e.g., Bird, 1932; Bick and Bick, 1957; Donnelly, 2004a, b, c; Abbott, 2005), and museum specimens. Our initial pass through these sources provided us with a starting point of species lists for each of Oklahoma's 77 counties. Our results disheartened us when we learned that fewer than ten species had been recorded in some counties and there were dozens that had 30 or fewer (Fig. 1, upper). We reasoned that species richness must reach at least 40 in every county, so we devised a color-coded map to guide our sporadic survey efforts from 2009 through 2011 (our efforts were far more systematic from 2012 through 2014).

We continued to compile literature, field note, photographic, and specimen records. We obtained specimen records from more than twenty museums, a half a dozen of which we visited personally to inventory ~8,000 specimens. Over

the years we have gathered >38,000 records, accounting for roughly 17,000 specimens and hundreds of thousands of individual odonates in the state (our own field notes account for >133,000 individual odonates!). All of these records are georeferenced, and a third of them come from the Dust Bowl era (1930s) and earlier (dating back to 1877) and thus offer a glimpse into the state's odonates decades earlier. And little by little we pieced together the basis for literature records. During this process, we were deflated sometimes, such as when we had to remove a species from the state list (see below), or when we visited the University of Michigan's Museum of Zoology to discover that misattribution of a series of specimens meant we had to remove a half-dozen species from Custer, a county already wanting, only to add them to the neighboring Caddo, a county that already enjoyed a large species total. On the bright side, we were heartened on occasion when we discovered new state records that had gone unidentified or had been misidentified (Table 1; Smith-Patten and Patten, 2012, 2013b).

As the 2012 field season drew to a close, we had closed in on 40 species in every county—we were just one county short (Fig. 1, center)—so we recalibrated the threshold to 50 species as it became clear to us, on the basis of our field work and data compilation, that 50 species was attainable and reasonable in every county. We operated with a 50-species threshold as a target in 2013 and 2014. As the 2014 field season closed, only 13 of the 77 counties remained below the threshold, with no county below 45 species (Fig. 1, lower). All told, since 2009 we have added 1752 species across the 77 counties!

Another aspect of our data compilation has been an effort to identify what sort of documentation supported each spe-

cies in each county, the goal being to ensure that extant specimens or archived photographs supported every county record. In a majority of instances we have located specimens that support a county occurrence, and for a majority of records for which we have not located a specimen an identifiable photograph is archived at OdonataCentral. There are now a mere 3.2%—146 county records of 4611 summed across all counties—of records supported solely by a literature reference. Similarly, a mere 3.3% (150 of 4611) of all county records are sight records. Hence, 93.6% of the 4611 county records are supported by specimens or identifiable photographs. We moreover determined that all but twelve of the 168 species (i.e., 92.9%) recorded in the state are supported by extant specimens (Table 2).

### The State List

It was generally accepted that at the end of 2008 Oklahoma's list of Odonata stood at 136 species (Abbott 2005). One of these species, the Spotted Spreadwing (*Lestes congener*), had long been attributed to the state, but the male specimen on which Bick (1991) had based the claim actually is a Plateau Spreadwing (*L. alacer*; Patten and Smith-Patten 2013a). To counter this slight loss in richness, we discovered three species in museum collections that had not been published (Table 1; Smith-Patten and Patten, 2012, 2013). There were also two species that had yet to be reported. A Western Forktail (*Ischnura perparva*) was collected in 2003 at Ft. Sill by Boris C. Kondratieff and his colleagues but was not published until three years later (Zuellig *et al.*, 2006; OC 381755). The only Oklahoma record of Lance-tipped Darner (*Aeshna constricta*) was photographed in 2004 but was not identified until 2011 (OC 334055). So in reality, 140 species had been recorded in the state when Donnelly (2004a, b, c) and Abbott (2005) published their works, although four of those species were in hiding.

Since 2005, 28 additional species have been found in Oklahoma, bringing the state list to 168 species, a total tied with Massachusetts for the eleventh highest state list in the country. All but a handful of these additional species have been found repeatedly (Table 1), although three—Western Forktail, Leonora's Dancer, (*Argia leonorae*), and Banner Clubtail (*Gomphus apomyius*)—have been recorded but twice each and may yet prove to be vagrants to the state. Breeding activity (tandem pairs or females ovipositing) has been documented for two other species, Duckweed Firetail (*Telebasis byersi*) and Bayou Clubtail (*Arigomphus maxwelli*), that have been recorded only twice each.

### Overlooked Species and Colonizations

Among recent additions to the state list, four species have small but established breeding populations in the

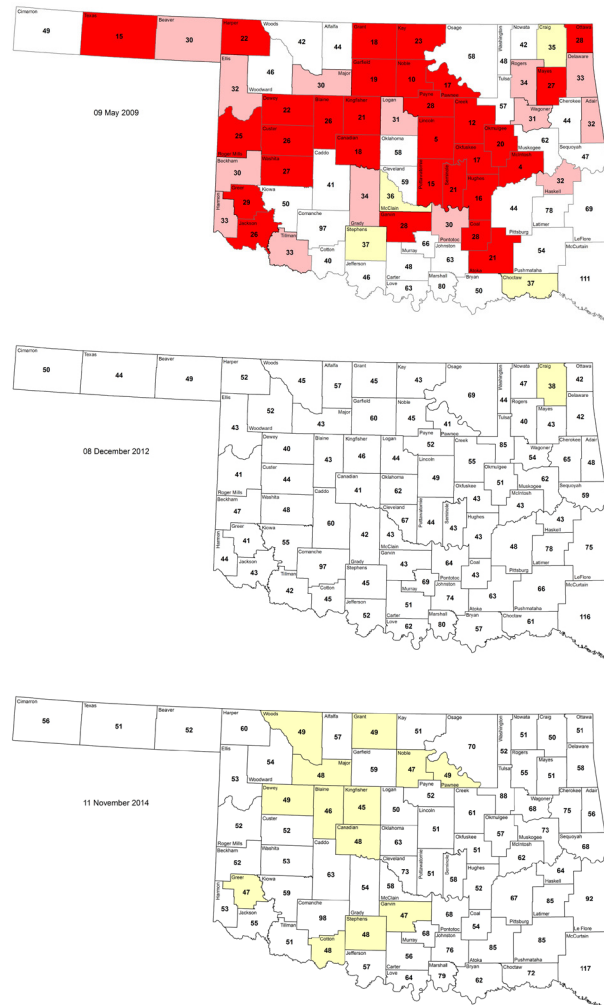


Figure 1. Oklahoma odonate species richness by county: when the statewide project began (top); at the end of the mid-way point (center); and at the end of the 6th year (bottom). In the top two maps, color codes are: red <30 species; pink 30-34 species; pale yellow 35-39 species; white  $\geq$ 40 species. In the bottom map, color codes are: red <40 species; pink 40-44 species; pale yellow 45-49 species; white  $\geq$ 50 species.

state and probably were overlooked previously: Atlantic Bluet (*Enallagma doubledayi*; Patten and Smith-Patten, 2012), Sphagnum Sprite (*Nehalennia gracilis*; Smith-Patten and Tucker, 2014), Ashy Clubtail (*G. lividus*), and Selys's Sundragon (*Helocordulia selysii*). Another species, Marl Pennant (*Macrodiplex balteata*), occurs regularly but appears to have colonized in the past six years given that it now has been recorded in 19 counties in western Oklahoma, with breeding activity (ovipositing, tandem pairs) observed in several counties (Comanche, Jackson, and Ellis). Two other species, Amber-winged Spreadwing (*Lestes eurinus*) and Bleached Skimmer (*Libellula composita*), may be in the process of colonizing the state. The single female spreadwing collected in Pushmataha County in 2013 was thought to be a vagrant (Patten and Smith-Patten, 2013a, b; SP 688),

but 2014 saw multiple records in northeastern Cherokee County, including five in one day in mid-June (OC 423037) and multiple females there in early July (OC 424308). Likewise, the single male Bleached Skimmer photographed in Texas County in 2011 (OC 331112) was thought to be a vagrant, but less than a year later four males and a female, including a tandem pair, were discovered in Beckham County (OC 375611; SP 276), and in 2013 three males and a female, with another tandem pair, were photographed in Ellis County (OC 401522 and 401523) one day after a remarkable 18 males were counted at the site of the original record in Texas County (SP 796).

Regal Darner (*Coryphaeschna ingens*), Two-striped Forceptail (*Aphylla williamsoni*), Cocoa Clubtail (*G. hybridus*), and perhaps Twin-spotted Spiketail (*Cordulegaster maculata*) occur regularly or nearly so in spring or summer in McCurtain County (the darner recently was recorded in Atoka, too; OC 424926), but it is not clear to what extent these species breed in the state. Likewise, Western Pondhawk (*Erythemis collocata*) has been well documented at least three times in western Cimarron County (Smith-Patten and Patten, 2013b) at the tip of the panhandle, and it may breed there on occasion. Two other species, Hyacinth Glider (*Miathyria marcella*) and Striped Saddlebags (*Tramea calverti*), have been recorded multiple times in autumn, but records likely refer to post-breeding movement north of normal breeding areas. Similarly, the single record of White-faced Meadowhawk (*Sympetrum obtrusum*; Smith-Patten and Patten, 2013a) and the multiple records of Saffron-winged Meadowhawk (*S. costiferum*; Table 1) appear to have wandered post-breeding south of their ranges during periods of strong northerly winds. Their occurrences coincide with small invasions that the Cherry-faced Meadowhawk (*S. internum*) stages at irregular intervals (Smith-Patten and Patten, 2013a). The sole Striped Meadowhawk (*S. pallipes*) also may have been a wind-borne vagrant, but the species may be a more regular visitor. Although known currently from a single record, we suspect the Seaside Dragonlet (*Erythrodiplax berenice*) will be shown to be a resident in salt marshes of the southwestern-most part of the state. Likewise, Black Setwing (*Dytthemis nigrescens*; Smith-Patten 2014) may occur regularly in southwestern Oklahoma.

Lastly, the sole record of a Ouachita Spiketail (*Cordulegaster talaria*; Heck, 2011) hints at the possibility of an undiscovered breeding population in Oklahoma at this locality of this recently described species (Tennesen, 2004), and the same may hold for the sole Allegheny River Cruiser (*Macromia alleghaniensis*) documented in the state (OC 376227) given the small population known from adjacent western Arkansas (Harp and Harp, 1996).

## Declines and Disappearances

As we noted in our assessment of species of special concern for Oklahoma (Patten and Smith-Patten, 2013b), various species known from the state were collected formerly in large numbers but now are scarce and seldom found. Key examples include Smoky Rubyspot (*Hetaerina titia*) and Mexican Forktail (*Ischnura demorsa*), each of which has been recorded only a few times in the past five years or more. Other species, such as Plateau Spreadwing (*Lestes alacer*), remain fairly numerous but appear to have declined given the current status relative to prior collection records. One species, the Little Blue Dragonlet (*Erythrodiplax minuscula*), was recorded sporadically in the state from the early 1930s to late 1960s, was “re-found” in the southeastern corner of the state in the late 2000s, and yet has not been recorded anywhere in the state in the past four years. Likewise, Rainbow Bluet (*Enallagma antennatum*) was recorded routinely in Cimarron and Alfalfa Counties but went unrecorded from the mid-1970s until 2013, when two individuals were discovered (SP 587, 594). This lotic species, just like the rubyspot and forktail mentioned above, may vanish from the state as streams in western Oklahoma desiccate with a combination of drought and draining of aquifers to irrigate crops.

## Hybridization

Hybrid zones are well known on the Great Plains, particularly among vertebrates (Moore, 1977; Rising, 1983) and along the eastern edge of the Rocky Mountains (Swenson and Howard, 2005). Three hybrid zone and contact zone “hotspots” have been identified in Oklahoma: one in the western panhandle, one southwest of the Wichita Mountains in the southwestern corner of the state, and one at the western edge of the Ouachita Mountains in the southeastern quadrant (Swenson and Howard, 2005). These three zones occur where key biotic provinces meet, i.e., respectively, the Navahonian and Kansan, Kansan and Texan, and Texan and Austroriparian (*sensu* Abbott and Stewart, 1998). Moreover, as Moore (1977) noted, “The occurrence of the [Great Plains hybrid] zones appears to correlate with a change in climatic conditions, viz., precipitation. It is also possible that this region represents an interface between distinct floristic assemblages, i.e., an ecotone.”

Oklahoma is thus a biogeographic crossroads, where faunas from eastern North America, western North America, and subtropical northern Mexico (and south Texas) converge. This convergence yields high species richness, which is wonderful, but also has led to our routine discovery of apparent hybrids and other anomalies. Some hybrids, such as a couple of potential Eastern × Western Pondhawks (*Erythemis simplicicollis* × *E. collocata*; SP 745, 746) in the

Table 1. Odonata species added to the Oklahoma state list 2003-2014. Records marked with an asterisk remain the sole ones for that species. "Historical records" are specimens that languished in museum collections that had not been identified or published.

English Name	Scientific Name	Date	County	Observers
<b>Historical Records</b>				
Leonora's Dancer <sup>†</sup>	<i>Argia leonorae</i>	9 Jul. 1932	Comanche	R. D. Bird
Brimstone Clubtail*	<i>Stylurus intricatus</i>	~25 Aug. 1932	Harper	A. E. Pritchard
Western Pondhawk	<i>Erythemis collocata</i>	5 Aug. 1970	Cimarron	L. E. Hornuff
<b>Contemporary Records</b>				
Western Forktail	<i>Ischnura perparva</i>	20 Sept. 2003	Comanche	B. C. Kondratieff
Lance-tipped Darner*	<i>Aeshna constricta</i>	18 Oct. 2004	Tulsa	B. Carrell
Bayou Clubtail	<i>Argomphus maxwelli</i>	25 Apr. 2005	McCurtain	D. Arbour
Two-striped Forceptail	<i>Aphylla williamsoni</i>	28 Aug. 2005	McCurtain	D. Arbour
Evening Skimmer*	<i>Tholymis citrina</i>	20 Apr. 2006	McCurtain	D. Arbour
Striped Saddlebags	<i>Tramea calverti</i>	19 Aug. 2006	Tulsa	J. Fisher & B. Carrell
Cocoa Clubtail	<i>Gomphus hybridus</i>	4 Apr. 2007	McCurtain	B. A. Heck
Hyacinth Glider	<i>Miathyria marcella</i>	10 Oct. 2007	McCurtain	D. Arbour
Cardinal Meadowhawk*	<i>Sympetrum illotum</i>	30 Oct. 2007	Comanche	V. W. Fazio III
Selys's Sundragon	<i>Helocordulia selysii</i>	21 Mar. 2008	McCurtain	B. A. Heck
Regal Darner	<i>Coryphaeschna ingens</i>	7 Jul. 2008	McCurtain	D. Arbour & B. Heck
Filigree Skimmer*	<i>Pseudoleon superbus</i>	30 Sept. 2008	Jefferson	V. W. Fazio III
Marl Pennant	<i>Macrodiplax balteata</i>	12 Jul. 2009	Comanche	V. W. Fazio III
Twin-spotted Spiketail	<i>Cordulegaster maculata</i>	20 Apr. 2010	McCurtain	B. A. Heck
Ashy Clubtail	<i>Gomphus lividus</i>	7 May 2010	McCurtain	B. A. Heck
Banner Clubtail	<i>Gomphus apomyius</i>	15 May 2010	McCurtain	B. A. Heck
Duckweed Firetail	<i>Telebasis byersi</i>	14 Jun. 2010	McCurtain	D. A. Arbour
Ouachita Spiketail	<i>Cordulegaster talaria</i>	18 Apr. 2011	McCurtain	B. & G. Heck
Bleached Skimmer	<i>Libellula composita</i>	5 Aug. 2011	Texas	V. W. Fazio III
Allegheny River Cruiser	<i>Macromia alleghaniensis</i>	20 Jun. 2012	McCurtain	B. A. Heck
Atlantic Bluet	<i>Enallagma doubledayi</i>	2 Sept. 2012	Atoka	MAP & BS-P
White-faced Meadowhawk*	<i>Sympetrum obtrusum</i>	22 Sept. 2012	Kingfisher	MAP & BS-P
Saffron-winged Meadowhawk <sup>‡</sup>	<i>Sympetrum costiferum</i>	11 Oct. 2012	Grant	J. R. Heinen
Sweetflag Spreadwing*	<i>Lestes forcipatus</i>	9 Jun. 2013	LeFlore	MAP & BS-P
Amber-winged Spreadwing	<i>Lestes eurinus</i>	10 Jun. 2013	Pushmataha	MAP & BS-P
Black Setwing*	<i>Dythemis nigrescens</i>	9 May 2014	Jackson	BS-P
Sphagnum Sprite	<i>Nehalennia gracilis</i>	3 Jun. 2014	Atoka	BS-P & J. Tucker
Seaside Dragonlet*	<i>Erythrodiplax berenice</i>	3 Aug. 2014	Jackson	MAP & BS-P
Striped Meadowhawk*	<i>Sympetrum pallipes</i>	9 Sept. 2014	Cimarron	B. Carrell
Plateau Dragonlet*	<i>Erythrodiplax basifusca</i>	21 Oct. 2014	Harmon	MAP & BS-P

†A ♂ photographed and examined in hand by T. Kompier, 28 July 2011, Kiowa Co. (OC 333094) was thought to be the 1st state record, but three years later we discovered this ♂ in the Sam Nobel Museum at Univ. of Oklahoma.  
 ‡We thought four ♂ observed in Kay Co. on 15 Oct. 2014, two of which were collected and one photographed (OC 427449) were the 1st state record; a few days later we determined Heinen had photographed the species in Grant (OC 382090) and Kay Co. (OC 382107) in 2012 and collected two ♂ and one ♀, identified as *S. vicinum*.



western tip of the panhandle, have not surprised us (see Smith-Patten and Patten 2013b), and perhaps the same can be said of the ♂ Twelve-spotted × Widow Skimmer (*Libellula pulchella* × *L. luctuosa*; SP 1016) hybrid we collected in Canadian County in the central part of the state in September 2013. A possible Cherry-faced × White-faced Meadowhawk (*Sympetrum internum* × *S. obtrusum*; SP 430) is not surprising as Donnelly (1997) discussed such a cross, although it was remarkable given that it made its way to Oklahoma, where *S. obtrusum* has been documented definitely just once and *S. internum* occurs irregularly (Smith-Patten and Patten, 2013a).

Other hybrids have shocked us, foremost among them a ♂ river cruiser (*Macromia*) that is an apparent Swift × Bronzed (*M. illinoensis georgina* × *M. annulata*) in Ellis County in the northwestern portion of the state in July 2013 (SP 785). This record stuns us on two fronts: it marks the first known hybrid between the two species, and it was found in an area outside the range of either species; indeed,

*M. annulata* is unknown from Oklahoma. Equally shocking is that we have collected a potential Comanche × Great Blue Skimmer (*L. comanche* × *L. vibrans*; SP 1036) hybrid in Harper County in the northwestern corner of the state, an area well within the range of *L. comanche* but well outside that of *L. vibrans*.

Zygoptera, too, have provided a challenge, not least the various ♂ Eastern Forktail (*Ischnura verticalis*) specimens we have collected that have paired spots on the thorax akin to a Plains Forktail (*I. damula*). Is this a sign of gene flow? What do we make of the Familiar Bluet (*Enallagma civile*; SP 1466) from Jackson County in October 2014 that has typical *E. civile* cerci but displays a pattern of extensive black on the dorsal surface of the abdomen that matches exactly the pattern on various ♂ Tule Bluets (*E. carunculatum*) we have collected in Oklahoma and elsewhere? Is this individual a hybrid between these two species? And what can we say of the handful of ♂ dancer (*Argia*) specimens we have collected in the central portion of the state, from Kay

Table 2. Odonata species on Oklahoma's state list that are not supported by an extant specimen.

English Name	Scientific Name	Date	County	Source
<b>Historical Records</b>				
Chalky Spreadwing <sup>†</sup>	<i>Lestes sigma</i>	22 Jul. 1968	Marshall	Bick (1978)
Cinnamon Shadowdragon <sup>‡</sup>	<i>Neurocordulia virginiana</i>	17 Jun. 1934	McCurtain	Byers (1937)
<b>Recent Records</b>				
Lance-tipped Darner	<i>Aeshna constricta</i>	18 Oct. 2004	Tulsa	OC 334055
Cardinal Meadowhawk	<i>Sympetrum illotum</i>	30 Oct. 2007	Comanche	OC 263515
Filigree Skimmer	<i>Pseudoleon superbus</i>	30 Sept. 2008	Jefferson	OC 284013, 284120
Twin-spotted Spiketail	<i>Cordulegaster maculata</i>	20 Apr. 2010	McCurtain	OC 318493, 327593, 374173, 374178
Banner Clubtail	<i>Gomphus apomyioides</i>	15 May 2010	McCurtain	OC 318873, 327591
Ouachita Spiketail	<i>Cordulegaster talaria</i>	18 Apr. 2011	McCurtain	Heck (2011); OC 327732
Allegheny River Cruiser	<i>Macrimia alleghaniensis</i>	20 Jun. 2012	McCurtain	OC 376227
Black Setwing	<i>Dythemis nigrescens</i>	9 May 2014	Jackson	Smith-Patten (2014); OC 422099
Striped Meadowhawk	<i>Sympetrum pallipes</i>	9 Sept. 2014	Cimarron	OC 426895
Plateau Dragonlet	<i>Erythrodiplax basifusca</i>	21 Oct. 2014	Harmon	OC 427500

<sup>†</sup> Bick collected this ♂ but the identification was confirmed by the venerable Leonora K. Gloyd, then with Univ. of Michigan. We have been unable to find the specimen at the IORI in Gainesville Florida, where most of Bick's collection was donated, or at the Univ. of Michigan Museum of Zoology. <sup>‡</sup> Byers (1937) reported in a footnote a ♀ collected by J. Standcavish in SE Oklahoma. The identification was determined by W.T. Davis (see Davis, 1937) who published the species' type description. We have been unable to locate the specimen, which may have remained in A.E. Pritchard's collection, only some of which we have been able to track.

County south to Garvin County, that largely match the Springwater Dancer (*A. plana*) in terms of their cerci but have thick black antehumeral stripes, sometimes forked and sometimes not, reminiscent of the antehumeral stripes on the Blue-ringed Dancer (*A. sedula*) or Kiowa Dancer (*A. immunda*)? Is this anomalous pattern an indication of gene flow? If so, which species have hybridized? And why have we located such individuals only in the center of the state, on the western fringe of the crosstimbers belt?

These questions and many like them will ensure that the Oklahoma project moves forward in earnest. Clearly, much remains to be discovered.

Abbreviations: OC = Odonata Central <<http://www.odonatacentral.org/>>; SP = Smith-Patten/Patten collection (housed at the Oklahoma Biological Survey).

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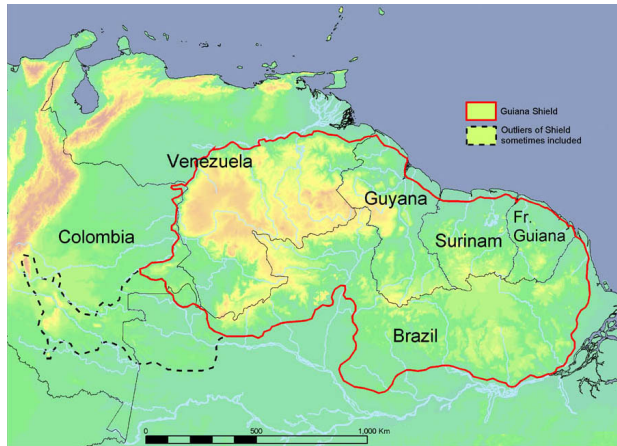
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## Records Request for Research Project on *Argia* of the Guiana Shield

Rosser Garrison <rgarrison@gmail.com>

Dr. Natalia von Ellenrieder and I are working on a manuscript entitled “Damselflies of the genus *Argia* of the Guiana Shield (Odonata: Coenagrionidae)”. We have documented 19 species, of which 11 are new. The illustrations are mostly down as are locality maps but the text still needs to be written.

The following described species are known from the region: *Argia collata* Selys, *A. euphorbia* Fraser, *A. fumigata* Hagen in Selys, *A. insipida* Hagen in Selys, *A. oculata* Hagen in Selys, *A. pulla* Hagen in Selys, and *A. translata* Hagen in Selys. In describing our new species, we are




Map showing the outline of the Guiana Shield..

comparing them with other species not known to occur within the Guyanan Shield and we are also treating some of the extra-limital species in more detail. We are requesting help on the following points:

***Argia insipida*:** This species is known from the Guyanas and Colombia and, curiously, from Costa Rica. We have seen no records from Panama for this species. Does anybody have records of *A. insipida* from Panama or from Nicaragua?

***Argia pipila* Calvert:** This species is similar to *A. insipida* and to the more northerly *A. barretti* and has been recorded as far south as Honduras, although there is an unpublished record supposedly of this species from Nicaragua in the University of Florida collections. This specimen may represent *A. insipida* and needs to be re-examined. Does anybody have records of either species from Nicaragua or San Salvador or Honduras?

***Argia frequentula* Calvert:** We collected specimens from southernmost Costa Rica (Puntarenas Province, Rio km 20, 12 km east of Golfito on ruta 14; sandy stream, 8.6172°, -83.0644°) just northwest of the Panamanian border. Does anybody have records of this species from Panama?

If anyone has any records or information to share, please contact me at <rgarrison@gmail.com>. 

### Would You Like to See Any New Features in ARGIA?

If you have ideas for new features for future issues of ARGIA that could make it an even more interesting, useful, or eye-catching publication, contact the Editor at <celeste@xerces.org>. Several current regular features such as the Advice Column and How I Fell Into the Clutches of the Odonata stemmed directly from reader suggestions, and we're always looking for good ideas.

# First Record of the Sphagnum Sprite (*Nehalennia gracilis*) for Oklahoma

Brenda D. Smith-Patten, Oklahoma Biological Survey, University of Oklahoma <argia@ou.edu> and  
Jona A. Tucker, The Nature Conservancy of Oklahoma

During a short visit on 3 June 2014 to The Nature Conservancy's Boehler Seeps and Sandhills Preserve in Atoka County, Oklahoma, we captured one of two male Sphagnum Sprites (*Nehalennia gracilis*; OC 422877) that we saw. Even though the species was new for Oklahoma, it was predicted to occur in the state by Greg W. Lasley, who urged us to check boggy beaver ponds in the southeastern corner of the state, so it was not surprising that we found the sprite at this preserve. Subsequent visits to the site in June by the lead author and Michael A. Patten confirmed suspicions that a breeding population was present (6 June, 8 ♂, 5 ♀ including 1 pair, OC 422884, Fig. 1; 13 June, 7 ♂, 1 ♀). On 20 July 2014 only one female was noted and no others were seen during the subsequent and final visit to the site for the season on 26 September 2014.

The Sphagnum Sprite is an eastern species that does not come terribly far inland from the eastern seaboard or south from the Great Lakes region. Until our find in Oklahoma there were three occurrences of the species known west of the Mississippi River—all disjunct populations, one each for Missouri, Texas, and Louisiana. The Missouri population was originally discovered in 1930 by E.B. Williamson, the same Williamson who was the first to document odonates in Oklahoma in 1907. In July 1930 he found a small population in Shannon County (Williamson, 1932), but the species was not seen again until it was rediscovered in the neighboring county of Dent, near Salem, in July 2009 (Walker *et al.*, 2009). Like the Oklahoma population, the Dent County population was associated with *Argia bipunctulata* (Seepage Dancer). The Texas population was initially found on 13 May 2009 by Terry Hibbitts at the Angelina National Forest, Jasper County (OC 313263), but it went unreported and unidentified until Lasley and others visited the site in early to mid-June. On the first visit Lasley collected a ♂ specimen and identified it as *Nehalennia gracilis* (Lasley and Abbott, 2009; OC, UTIC, JCA) after which time Hibbitts realized he had photographed the species in May. The Louisiana population was discovered on 15 May 2011 in Rapides Parish by Steve Shively (OC 327981). On that day, Shively collected two ♀ specimens and saw several other adults. Other specimens were collected by Steve and Micah Shively on 18 and 22 May 2011.

In both Oklahoma and Texas, the Sphagnum Sprite has been found in forested areas with beaver ponds containing sphagnum. In Texas the edges of the ponds were described as “liberally covered” in sphagnum moss. Walker *et al.*

(2009: 19–20) described the Missouri location as a “deep-muck fen”, also saying that “Unlike the typical habit [*sic*] of sphagnum bogs, *N. gracilis* was observed in the Dent County fen flying among the sedges and other forbs typical for fens in the Missouri Ozarks.” The U.S. Fish and Wildlife Service’s National Wetlands Inventory (USFWS NWI) classified the Missouri fen as a palustrine area with emergent vegetation and saturated soils (Walker *et al.*, 2009). The Louisiana location was described by Steve Shively as a “shady, swampy area below beaver dams.” This locality is classified as a temporarily flooded palustrine area containing deciduous, broad-leaved trees (USFWS NWI).

Boehler Seeps and Sandhills Preserve is a 235-ha site that contains marshes, streams, sandhills, acidic hillside seeps, and two beaver-formed, shallow lakes (Clark, 2011), one of which, Boehler Lake, is where the sprites were found. Boehler Lake, classified as a semi-permanently flooded palustrine environment with broad-leaved deciduous scrub-shrub and persistent emergent vegetation (USFWS NWI), is found within the watershed of the Muddy Boggy and Clear Boggy Creeks and has a surface area



Pair of Sphagnum Sprites (*Nehalennia gracilis*) photographed on 6 June 2014 in Atoka County, Oklahoma, at Boehler Seeps Preserve, where this species was first found on 3 June. Photo by Michael A. Patten.

of <3 ha (McKnight *et al.*, 2012). The lake is open at its center but it has “dense stands of emergent and floating-leaved species” at its edges; the “dominant taxa include [narrowleaf southern cat-tail] *Typha angustifolia*, [yellow water lily] *Nuphar lutea*, and [fragrant water lily] *Nymphaea odorata*. Often quite abundant, free-floating species are [Carolina mosquito fern] *Azolla caroliniana* and [two-flowered bladderwort] *Utricularia biflora* (Clark, 2011: 5).” The sponginess one feels when walking in the lake is from the carpets of vegetation that are dominated by Lescur’s sphagnum (*Sphagnum lescurii*) and common haircap moss (*Polytrichum commune*) (Clark, 2011).

Visits to Boehler Seeps produced rather large numbers, for Oklahoma at least, of the Seepage Dancer (*Argia bipunctulata*; highest count was 50 ♂, 10 ♀, including 5 pairs, on 13 June) and Gray Petaltail (*Tachopteryx thoreyi*; 15 ♂, 13 June). Other species recorded were: Ebony Jewelwing (*Calopteryx maculata*), Azure Bluet (*Enallagma aspersum*), Fragile Forktail (*Ischnura posita*), Citrine Forktail (*I. hastata*), Cyrano Darner (*Nasiaeschna pentacantha*), Common Green Darner (*Anax junius*), Arrowhead Spiketail (*Cordulegaster obliqua*), Mocha Emerald (*Somatochlora linearis*), Common Whitetail (*Plathemis lydia*), Widow Skimmer (*Libellula luctuosa*), Yellow-sided Skimmer (*L. flavida*), Spangled Skimmer (*L. cyanea*), Slaty Skimmer (*L. incesta*), Great Blue Skimmer (*L. vibrans*), Golden-winged Skimmer (*L. auripennis*), Eastern Amberwing (*Perithemis tenera*), Eastern Pondhawk (*Erythemis simplicicollis*), Band-winged Dragonlet (*Erythrodiplax umbrata*), Blue-faced Meadowhawk (*Sympetrum ambiguum*), Blue Dasher (*Pachydiplax longipennis*), Black Saddlebags (*Tramea lacerata*), and Wandering Glider (*Pantala flavescens*). The dancer and emerald were new to Atoka County, as was a species of special note for this preserve: the Regal Darner

(*Coryphaeschna ingens*). Prior to 20 July 2014 (OC 424926), the Regal Darner was only known to occur in Oklahoma at and nearby Red Slough Wildlife Management Area, McCurtain County. All of these species taken together are a testament of the quality of habitat at Boehler Seeps.


### Abbreviations

UTIC = University of Texas Insect Collection  
JCA = John C. Abbott Collection

### Acknowledgements

We thank Bruce W. Hoagland, Michael A. Patten, and Greg W. Lasley for comments on the manuscript.

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## Request for Aberrant Specimens of *Ischnura* (Forktails)

Do you have any aberrant specimens of *Ischnura verticalis* (Eastern Forktail), *I. damula* (Plains Forktail), or *I. demorsa* (Mexican Forktail) in your collection? If so, your specimens would help us with a study on the geographic variation in these species.

Please contact Brenda D. Smith-Patten at <argia@ou.edu> with information or questions.

## Call for Papers for BAO

Bulletin of American Odonatology needs your manuscript submissions to help us keep BAO the vehicle for timely reporting of research on Odonata of the New World.

If you have questions about BAO guidelines, please see the last page of this issue of ARGIA or contact Steve Hummel, BAO Editor, at <mshummel@iowatelecom.net>.

## Dragonflies of North America, 3rd Edition: Errata

Mike May <may@aesop.rutgers.edu>

Since the publication of the 3rd Edition of *Dragonflies of North America* earlier this year, several omissions or errors have been brought to my attention. In hopes of saving at least some readers the confusion, and in some cases, apparently, the downright anguish, that might result, I list the known instances here, by page number:


p. 85: In the list of pertinent literature given in the account of *Anax walsinghami* (Giant Darner), the date of the original description by McLachlan is given as 1882; it should be 1883, as is correctly given in the Bibliography (p. 623).

p. 38, p. 150, p. 642, p. 652: In the List of Genera and Species, in the species account, and in the Common Name Index, the common name of *Erpetogomphus crotalinus* is given as Autumn Ringtail; the correct name, as approved by the Dragonfly Society of the Americas, is Yellow-legged Ringtail. This error came about as an unfortunate by-product of using a global change to amend the common name of *Sympetrum vicinum* (formerly Yellow-legged Meadowhawk) to Autumn Meadowhawk.

pp. 156–164: As the result of an extremely unfortunate and careless oversight on my part, the larvae of *Erpetogomphus bothrops*, *E. elaps* (Straight-tipped Ringtail), *E. eutainia* (Blue-faced Ringtail), and *E. liopeltis* were omitted from the key and listed as unknown in the respective species

accounts. Larvae of these four species were described and keyed by Rodolfo Novelo in 2005 (Five new *Erpetogomphus* Hagen in Selys larvae from Mexico, with a key to the known species [Anisoptera: Gomphidae]. *Odonatologica* 34(3): 243–257). My apologies to Rodolfo and to users of the Manual.

p. 284, p. 643, p. 649: At the time the Manual was published, *Phyllogomphoides nayaritensis* was included because it had been recorded in Sonora, Mexico, but it had not been collected in the United States and so had no “official” common name. Based on the written description, I proposed the name “Clear-faced Leaf-tail”, but was persuaded by Dennis Paulson and others with field experience of the species that this name would be misleading. I then settled on the suggested name of “West Mexican Leaf-tail”, which is used in the List of Genera and Species. On the pages listed above, however, i.e., in the species account and the Common Name Index, this last-minute correction was overlooked, and it remains as “Clear-faced Leaf-tail”. As of this writing, the species still has no DSA approved common name, but West Mexican Leaf-tail is more likely to be used.

If anyone finds other errors or discrepancies, I'd be very grateful if you would let me know so that they can also be corrected. 

## Odonates of Albany County, New York

Walter Chadwick <mcrnaturally@optonline.net>

On 7–8 September 2014, I made a visit to Albany, New York to look for odes. On the 7th I visited Five Rivers Environmental and Education Center in Delmar, which is managed by New York State's Department of Environmental Conservation and consists of 450 acres of ponds, marsh, stream, forest, and fields. There is a visitor center (closed Sundays), picnic tables and many trails, some of which are handicapped accessible. The ponds are where I did most of my searching and I wasn't disappointed. There are boardwalks over some of the ponds and wetlands, and observation platforms which provide good viewing areas. The day was sunny with temperatures in the 70s F. I was here in the late morning to mid-afternoon.

On the 8th I went to the Albany Pine Bush Preserve in Albany, New York, is a rare pine barrens formed at the end of the last ice age. It is 3,000 acres and consists of



Pond at Five Rivers Environmental and Education Center, Delmar, New York. Photo by Walter Chadwick.


pitch pines, scrub oak and sand dunes surrounded and fragmented by houses, highways, and malls. Trails are not difficult but there are ups and downs and some areas were closed to the public. A visitor center has information, maps and displays, so stop there first. Once again the day was sunny with temperatures in the 70s F. There is a separate part of the preserve, Rapp Barrens and Rensselaer Lake Preserve and Park, where I spent most of my time. Time was limited so I only covered the east shore of the lake and the west side of a marsh, an easy walk on a flat trail.

Below is a list of Odonates seen. Numbers indicate the site where each was observed (1 = Five Rivers Educational and Environmental Center; 2 = Albany Pine Bush Preserve; 3 = Rapp Barrens and Rensselaer Lake Preserve Park).

- Spotted Spreadwing (*Lestes congener*), 1, 3
- Common Spreadwing (*L. disjunctus*), 1
- Variable Dancer (*Argia fumipennis*), 3
- Familiar Bluet (*Enallagma civile*), 3
- Skimming Bluet (*E. geminatum*), 1
- Fragile Forktail (*Ischnura posita*), 1



Autumn Meadowhawk (*Sympetrum vicinum*) pair, Five Rivers Environmental and Education Center, Delmar, New York, September 2015. Photo by Walter Chadwick.


- Eastern Forktail (*I. verticalis*), 1
- Common Green Darner (*Anax junius*), 1
- Eastern Amberwing (*Perithemis tenera*), 3
- Autumn Meadowhawk (*Sympetrum vicinum*), 1, 2 

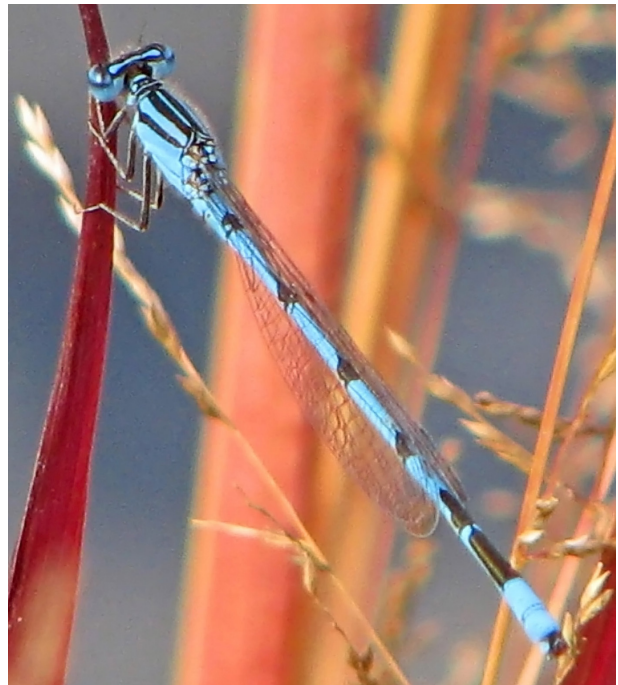
## New Sighting of Big Bluet (*Enallagma durum*) in Georgia

Vicki DeLoach <vldeloach@aol.com>

Big bluets (*Enallagma durum*) were seen flying from 19 October to 11 November 2014 at Bradshaw Lake in Cherokee County, Georgia. Giff Beaton came out on 21 October 2014 after seeing my photos and confirmed the identification.

Rambur's Forktails (*Ischnura ramburii*), a species I've rarely found in the upper Piedmont and had never seen at this lake, appeared on the same day as the *E. durum* and flew with them all along. Vesper Bluets (*Enallagma vesperum*) also appeared just prior to the *E. durum* and flew with them for a while—this too is a rare species here that I normally see only in the spring.

There are two old records for Big Bluet in Georgia from the Donnelly Dot Map Project, but I haven't found additional evidence to substantiate them. One record is from Jasper County (OC 178336), the other is from Baker County (OC 178335), both of unknown date. I checked with Nick Donnelly, Bill Mauffray, and Dennis Paulson about any possible old records or specimens, but have not found any additional information. So this is either the first sighting in decades, or a first state record—either way, a noteworthy observation! 



Big Bluet (*Enallagma durum*), Bradshaw Lake, Cherokee County, Georgia, 28 October 2014. Photo by Vicki DeLoach.

## On the Dutch Odonatologist Jean Belle

Marcel Wasscher, Minstraat 15 bis, 3582 CA Utrecht, The Netherlands <marcel.hilair@12move.nl>

Jean Belle (1920–2001) was born at Sukabumi in West Java, part of what was then the Dutch East Indies (now Indonesia). As a boy he learned how to roast insects such as locusts from the night watchmen who took care of his father's office buildings. When he had captured dragonflies (either by swinging a tennis racquet at them while they were flying around, or by collecting them at rest in the early morning), he laced them up on a string, roasted them and then ate them. This gave him an early 'taste' for the love of dragonflies. He often went with his father, an architect, on his surveys of projects on the island; this gave him the opportunity to study the rich tropical wildlife around him. He was of course unaware that, during 1929, Maus Lieftinck had come to the neighboring town of Buitenzorg (now Bogor) to work as an entomologist. In 1934 the Belle family moved to the Netherlands. Although he loved biology, Jean chose to study maths and science at the University of Amsterdam.

In 1947 Belle started his career as a Secondary School maths and science teacher. In 1950 he finished his studies (which were partly delayed by World War II) and married Maria Olfers. She too was born in the Dutch East Indies and in 1953 they decided to emigrate to the tropics, choosing Suriname. Together they had five sons and a daughter. One of Jean's hobbies was playing chess, and in 1955 he placed second in the Surinamese championships. He taught all of his sons how to play the game, but not his daughter ("chess is not for girls"). So she learned it from her twin brother, and defeated her father in their first game when she was thirteen. Much later she took further revenge by becoming female chess champion of the Netherlands in 1975, 1980, and 1981.

In Paramaribo, Jean was struck by a large collection of dragonflies in the newly opened Suriname Museum. These were collected by its director Dirk Geijskes, a Dutch entomologist based in Suriname since 1938. It was Geijskes who stimulated Jean to start collecting dragonflies in Suriname. He started collecting in 1955 and somewhat later he began corresponding with North American odonatologists. Along with Geijskes, these correspondents suggested to him that he might wish to specialize in neotropical Gomphidae. George Needham was at that time not able to have had an extensive correspondence with him (being already blind), but together with Philip Calvert he may well have been the stimulating factor that cemented this choice. At first, Jean started collecting within driving distance of Paramaribo; localities included many savannah creeks around Zanderij (from where he

obtained half of all the specimens he collected in Suriname) and also some sites in the direction of Albina. He travelled often, either at weekends or at times when his school schedule allowed; he was regularly assisted on these excursions by his wife and sometimes accompanied by his children. Later, we can learn from the data on his collected specimens that he also started going into the interior of Suriname, either by train (e.g. to Kabel or Gansee), or sometimes by boat (visiting the Corantijn River in 1956, the Tapahoni River in 1958, the Upper Suriname River in 1959, the Lawa and Litanie Rivers in 1960, the Copename River in 1961, the Nickerie River in 1962 and the Kabalebo River in 1963 and 1964). In 1965 the family returned to the Netherlands, where he continued his job as a Secondary School science teacher.

Belle started publishing on dragonflies in 1963, and continued to do so for the rest of his lifetime. He described many Odonata and did so with a mathematical precision. Some thought his drawings were perhaps too mechanical (e.g. simply filling in a template of the thorax), while others (like Heckman, 2006: 6) praise his papers for their very high quality. Altogether he described a total of 124 new species (Fig. 1), which ranks him as the tenth most important Odonata taxonomist of all time (as I calculated some years ago from the World Odonata list). The genus *Progomphus* (sanddragons) was his ultimate specialization within the Gomphidae. In 1966 he wrote about the species of this genus occurring in Suriname, adding three new species for science. In his 1973 publication (which served in 1974 as his Ph.D. thesis) he introduced another 21 species, and later still he added another eight. Fittingly, the

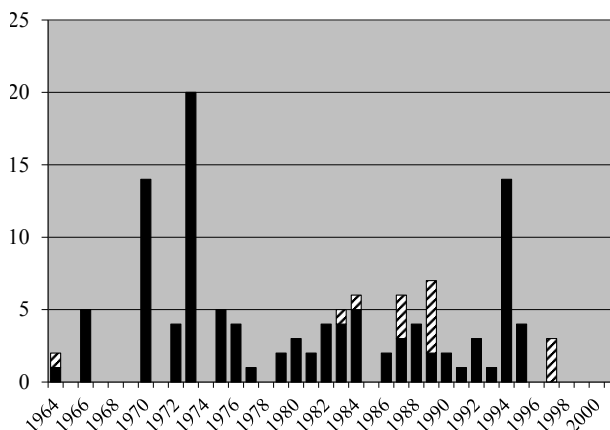


Figure 1. Number of new species of Gomphidae (black) and other Odonata (hatched) described by Jean Belle in each publication year. Data according to the world list of Odonata by Paulson and Schorr (2014); synonymized species are omitted.



only species named after him, *Progomphus bellei* Knopf & Tennessen, 1980 (Belle's Sanddragon) is a species in this genus.

Altogether he described 110 new gomphids and nine genera within this family. Outside of the many Gomphidae from Southern and Central America he also described a further 14 species, including Libellulidae (e.g. the elusive monotypic *Nothodiplax dendrophila*, a *Rhodopygia* and three *Macrothemis*), some Aeshnidae from the genus *Neuraeschna*, and also a few Lestidae from the genus *Lestes*. But he did not just describe new species, he also re-described many others. Having seen numerous original specimens in collections all over Europe, he similarly designated many lectotypes and some neotypes. Together with Jan van Tol, Belle also helped resolve the identity of the *Ischnura* population on the Azores, which turned out to be the American species *Ischnura hastata* (Citrine Forktail).

Belle never returned to Suriname after leaving in 1965, but his eldest son, J.J. (Jan), did so. During J.J.'s military service in 1973 he, too, even collected some dragonflies in the region, with the most spectacular capture being that of *Tramea basilaris burmeisteri*, the first African/Asiatic odonate species to be recorded in the Neotropics. A few years after his early retirement in 1979, Jean and his wife had been thinking about emigrating once again, this time to Costa Rica. After a second visit to the country, these plans were, however, brought to an abrupt end by the death of Maria in 1987. Belle did stay for seven months in Costa Rica during the period 1986–1989, and he was appointed as honorary curator in Panama in 1986, but he decided to remain living in the Netherlands. His own health was reasonable, though he had three bypass operations during the 1990s.

In 1987 Belle sold his personal odonate collections to RMNH (now Naturalis, Biodiversity Center) in Leiden, The Netherlands, but he kept on working in their rich Odonata collection as a volunteer. In 1992 we (JB and MW) both met there and we decided to work together on a checklist of the Odonata of Suriname. I checked the



Jean Belle catching dragonflies in Suriname in 1960.

collections and discussed some problems with Dennis Paulson and Rosser Garrison, and we then compiled a list. Unfortunately we ultimately disagreed on who would be the first author of



Jean Belle with an *Anax imperator* (Emperor Dragonfly) in a newspaper photo from the Guernsey Evening Press and Star, 24 July 1978.

the article, me not being modest enough to give him the full credit for having worked for so many decades as a great specialist on Odonata. Finally he did publish the paper on his own in 2001, though sadly he died of a heart attack while the paper was in proof.

Though many odonatologists know him by name, not many people have met him in person, for only during the seventies did he attend odonatological symposia. In groups he was modest, and in his work as a teacher he was quiet and meticulous in his duties. On dragonflies he worked with great precision; he once said he thought the motto that would fit him best would be "*Labor omnia vincit improbus*" ("Steady work overcame all things").

### Acknowledgments

Thanks are due to Bastiaan Kiauta, who gave me access to his personal library and photos; to Erica Belle, Jean's daughter, who spoke to me several times over the phone; and to Adrian Parr, for checking the English language.

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# Splash-Dunk Analysis for 2001–2014

James S. Walker, Anacortes, Washington <jswphys@aol.com>

On a warm, sunny day in September 2014, a group of 20 to 30 dragonfly enthusiasts gathered at Cranberry Lake in Anacortes, Washington for a splash-dunk/spin-dry field trip (Walker 2011a, 2013). The air was heavy with anticipation as all eyes scanned the water. We were at the right place at the right time to observe a fascinating and little-observed wonder of nature.

Suddenly, someone shouted “One!” and pointed toward a growing set of ripples. A darner emerged from the water, flew a short distance, then took the plunge again, creating a sizable splash. “Two!” Everyone was on the activity now, following the flight of the darner and calling out in unison as it continued to splash-dunk—“Three! Four! Five!”

Satisfied with its bath, the darner started to gain altitude, eventually flying almost vertically. Quickly pitching forward, it began to spin at 1,000 rpm for half a second, shedding water droplets in all directions (Walker, 2011b). Everyone gasped with delight. For many this was their first spin-dry, for others it was a chance to see the phenomenon once again. For my wife Betsy and I, who observe splash-dunk/spin-dry behavior every summer, this was roughly our 400th event. It never grows old.

## The Number of Splash-Dunks per Event

As we watch dragonflies splash-dunking and spin-drying every year, we record the number of splash-dunks in a given event (Walker 2011a, 2013). We count from the first splash-dunk to the last—a total of five in the example mentioned above—after which the dragonfly rises for its spin-dry. Many events consist of just a single splash-dunk, and events with two or three splash-dunks are quite common. Even so, we’ve seen events with as many as eight splash-dunks in a row. The results of our observations of a total of 454 events are presented in Figure 1.

The average number of splash-dunks per event is 2.29, almost unchanged from previous results (Walker, 2011a, 2013). In addition, the shape of the distribution is similar to earlier ones, though it has been fleshed out with two additional eight splash-dunk events and a single seven splash-dunk event. The slight “shoulder” at 3 splash-dunks is still evident, but reduced in magnitude.

## Temporal Distribution of Splash-Dunking

As we observe the splash-dunk/spin-dry behavior, we also record the date of each event. In Figure 2 we present the

temporal distribution of splash-dunks. Notice that the plot gives the percentage of splash-dunk events observed each month of the year. The most obvious feature is the strong peak at September, which is clearly the best month to look for this behavior.

During the peak of the season, we observe splash-dunk events roughly every five minutes at Cranberry Lake. As the frequency of splash-dunking falls off in October and November, and the temperature drops we usually start to see some dragonflies getting stuck when they hit the water (Walker, 2012). In past years, we have seen as many as 8–10 dragonflies stuck and struggling in the water at a time. To our surprise and relief, that didn’t occur this year.

## Spatial Distribution of Splash-Dunking

Almost all of our splash-dunk observations are made at Cranberry Lake. This is actually a bit surprising, because we’re always on the lookout for splash-dunks wherever we go dragonflying. For example, at Heart Lake in Anacortes, which could be a twin for Cranberry Lake and is only a

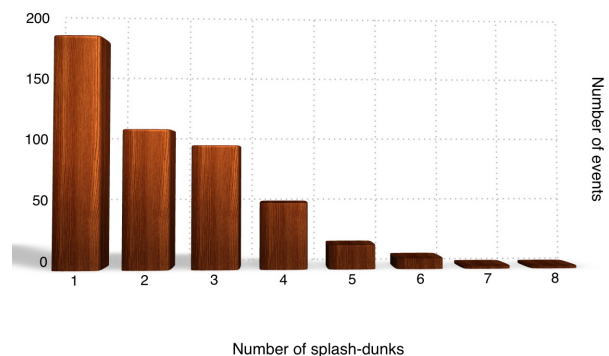


Figure 1. Cumulative data for 254 splash-dunk events observed during 2011–2014.

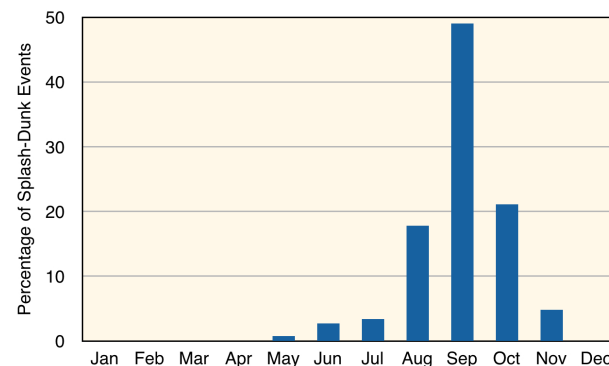


Figure 2. Temporal distribution of splash-dunk events. Almost half of all events occur in September.

few miles away, we always look for splash-dunks, but so far haven't seen a single one. In spite of our diligence, we've seen the behavior at only a few other locations.

Perhaps the best place for splash-dunking other than Cranberry Lake is Beaver Pond in Winthrop, Washington. We usually see several events on each visit to that location. On the other hand, other places in Washington that look favorable, like Lake Terrell in Ferndale and Magnuson Park in Seattle, have so far yielded no events.

### Splash-Dunk Species

Just as almost all our observations of splash-dunking come from Cranberry Lake, almost all the dragonflies engaged in splash-dunking are darners. Of these, almost all are Paddle-tailed Darners (*Aeshna palmata*), followed in frequency by the closely related Shadow Darner (*A. umbrosa*; Figure 3). Other darners observed to splash-dunk are California Darner (*Rhionaeschna californica*), Blue-eyed Darner (*R. multicolor*), and Common Green Darner (*Anax junius*)

In addition, we occasionally see species from other families of dragonflies engaging in splash-dunking, though usually just in isolated incidents. These species include Four-spotted Skimmer (*Libellula quadrimaculata*), Eight-spotted Skimmer (*L. forensis*), Western Pondhawk (*Erythemis collocata*), Autumn Meadowhawk (*Sympetrum vicinum*), and Blue Dasher (*Pachydiplax longipennis*).



Figure 3. Shadow Darner (*Aeshna umbrosa*, left) and Paddle-tailed Darner (*A. palmata*, right), Cranberry Lake. Both species are frequent and vigorous splash-dunkers.



Figure 4. Two Paddle-tailed Darners (*A. palmata*) rest on my hand as several Autumn Meadowhawks (*Sympetrum vicinum*) land on my body to soak up the sun.

Figure 4 shows two of the splash-dunking species at Cranberry Lake, the Paddle-tailed Darner along with a group of its sometimes prey, the Autumn Meadowhawk. The Autumn Meadowhawk does only a single splash-dunk on any given event, but so far they are the only species observed to do a spin-dry while attached in tandem.

Surely more dragonflies will be added to the list of splash-dunk species with continuing observations.

### Acknowledgements

I would like to thank Betsy Walker for help collecting the data presented here, and for co-leading our splash-dunk/spin-dry dragonfly field trips.

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## Eighteenth Century Dragonfly Records from New York

Marcel Wasscher, The Netherlands <marcel.hilair@12move.nl>

In an old publication, Houttuyn (1766) explains, in Dutch, the visual appearance of the various dragonfly species that had been described and/or illustrated up until that time. With the species listed by Linnaeus (1758) as a starting point, he discusses texts and illustrations by Ray (1710), Swammerdam (1737), Reamur (1742), Roesel (1746–1762), Edwards (1758–1764), Geoffroy (1762) and notes by Daniel Rolander.

In his paper he also includes a plate showing drawings produced by a friend, Mr. J. Admiraal. On this plate eight species are very clearly and accurately drawn, and several of these illustrations can be identified right up to species level. The text states that the specimens on which the drawings were based are all 'from abroad' (i.e. not from The Netherlands); they are also described as 'very rare' and 'never been illustrated before'. The rarity value will no doubt have made the plate more attractive to readers, though this is, of course, unsupported by any firm evidence.

The eight specimens illustrated (Fig. 1) had been sent to Admiraal from three locations: four from 'Nieuw Jork' (New York; nos. 1, 2, 3 and 4), two from Oostindien (at that time the East Indies, now Indonesia and surroundings; nos. 5 and 6) and two from Suriname (nos. 7 and 8). The identities of these eight species are as follows:

- 1) Later described as *Libellula semifasciata* Burmeister, 1839 (Painted Skimmer)
- 2) Later described as *Libellula pulchella* Drury, 1773 (Twelve-spotted Skimmer)
- 3) Later described as *Plathemis lydia* (Drury, 1773) (Common Whitetail)
- 4) *Tramea carolina* Linnaeus (1763) (Carolina Saddlebags)
- 5) *Neurothemis* sp.
- 6) Libellulidae sp.
- 7) Later described as *Mecistogaster lucretia* (Drury, 1773)
- 8) *Hetaerina* sp.

The four species collected from New York can be compared with later lists of Odonata recorded from this location. *Plathemis lydia* (Common Whitetail) has been reported from New York by USGS (2014), and *Tramea carolina* (Carolina Saddlebags) has been reported by Calvert (1895) from the vicinity of New York City, though it

was described as 'not common'. The other two species are mentioned in both publications. So all species depicted by Admiraal have been found in or around New York on later occasions as well [Editor's note: OdonataCentral shows *Libellula semifasciata*, *L. pulchella*, and *P. lydia* as widely distributed in New York state; the majority of records for *Tramea carolina* are in and near Long Island.]

Several American dragonflies had been described by Linnaeus (1758), with the type locality given simply as 'America'. Only in the case of the Carolina Saddlebags described by Linnaeus in 1763 is more information provided, the type locality here given as 'Carolina' (Paulson and Dunkle, 2012). The specimens used by Linnaeus during the writing of *Centuria Insectorum* in 1763 include some provided by Dr. Alexander Garden, a horticulturist from 'Charles Town in the Province of South Carolina' (Wikipedia, 2014). So this type locality for *T. carolina* might more specifically refer to Charleston, South Carolina.

Calvert (1895) describes the understanding of the Odonata of New York up until 1895. The oldest publication he refers to is by Emmons (1854). Both Calvert (1895) and Houttuyn (1766) did not give a year of capture for the species discussed. However, it seems likely that the four libellulids illustrated by Mr. J. Admiraal in Houttuyn (1766) are amongst the oldest records where it is known from whence individuals had been collected, in this case

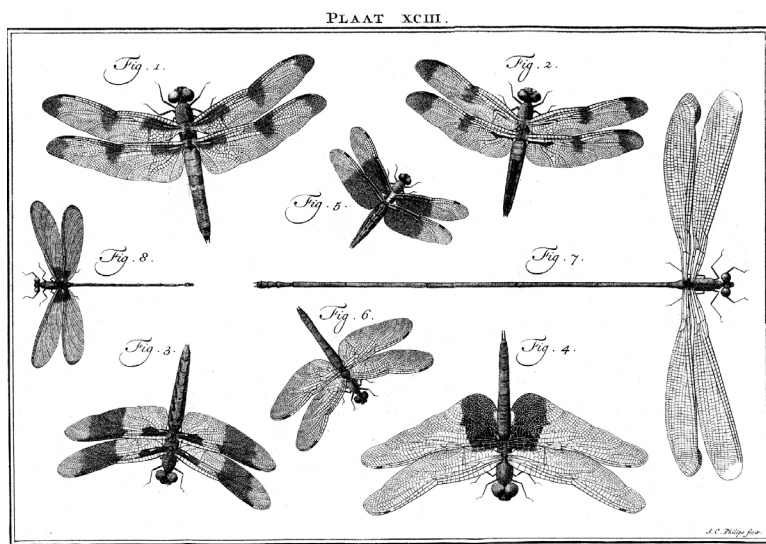


Figure 1. Plate XCIII from Houttuyn (1766). Eight odonate species sent to, and drawn by, Mr. J. Admiraal, from three locations: 'Nieuw Jork' (New York; nos. 1, 2, 3, 4); Oostindien (then East Indies, now Indonesia; nos. 5, 6); and Suriname (nos. 7, 8).

dating back to the years just before 1766. They are certainly among the oldest records for New York, and probably also for the USA as well.

### Acknowledgments

Thanks to Adrian Parr for checking the English language.

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## Odonata in the News

Odonata in the News is compiled by the Editor. Please feel free to send alerts about any noteworthy odonate-related items including news stories, popular articles, and scientific publications to me at <[celeste@xerces.org](mailto:celeste@xerces.org)>. A sampling of the most recent newsworthy odonata includes:

Córdoba-Aguilar, A. and D.M. González-Tokman. 2014. The behavioral and physiological ecology of adult rubyspot damselflies (*Hetaerina*, Calopterygidae, Odonata). *Advances in the Study of Behavior* 46: 311–341. A comprehensive look at multiple aspects of rubyspot ecology and mating, including alternative reproductive tactics, juvenile hormone influences on sexual behavior, effects of food at the larval and adult stages on adult condition, sperm competition, and the potential costs of that red wingspot we all love so much. Suggestions for future areas of research on this group are sprinkled throughout.

McCauley, S.J., C.J. Davis, E.E. Werner, and M.S. Roberson, II. 2014. Dispersal, niche breadth and population extinction: colonization ratios predict range size in North

American dragonflies. *Journal of Animal Ecology* 83(4): 858–865. This study evaluated 10 models based on predictions about the relationships between species traits and range sizes for 15 species of dragonfly. The authors found that only the traits of dispersal behavior and niche breadth (habitat usage) were strongly related, such that the dragonfly species that dispersed further and more frequently had the largest range sizes. Range size is an important predictor of extinction risk and thus understanding the factors that control range sizes gives a better idea of how resilient species may be to changes in both climate and landscape, and can help inform species conservation plans.

Khazan, E.S. 2014. Tests of biological corridor efficacy for conservation of a Neotropical giant damselfly. *Biological Conservation* 177: 117–125. Preserving biological corridors in impaired and fragmented landscapes may help maintain wildlife, but studies on corridor effects on specific taxa are limited. This study looked at the ability of the giant tree-hole breeding Neotropical damselfly *Megaloprepus caerulatus* to disperse from mature forests through

a corridor in the La Selva forest in Costa Rica and Nicaragua established to protect Great Green Macaws. The author investigated whether the corridor was limited due to having secondary regrowth (*M. caerulatus* prefers to breed in old growth), or too many unforested gaps between forest patches for the damselfly to cross. Larval and adult densities were lower in fragments than in mature forest, and individuals were less able to orient towards the forest when they were further away. Limitations in dispersal and perception ability suggest this corridor would better serve *M. caerulatus* if the remaining forest fragments are closer together and there is less intensive land use in the gaps.

Śniegula S., S.M. Drobniak, M.J. Gołąb and F. Johansson. 2014. Photoperiod and variation in life history traits in core and peripheral populations in the damselfly, *Lestes sponsa*. *Ecological Entomology* 39(2): 137–148. In geographically distant populations, development and growth rate may show genetic differentiation, but differences can be constrained by insufficient genetic variation. Genetic variation may also be higher at the center of a population and lower at the periphery, because population density and gene flow are higher at the center. A conflicting hypothesis holds that genetic variation should be higher at the population edges, where conditions are more stressful. The authors examined genetic variation and plasticity of life history traits and their response to manipulated photoperiod in populations of *Lestes sponsa* from a latitudinal gradient across Poland and Sweden. Central populations did not show higher genetic variance in life history traits compared with northern populations, and northernmost populations did not show less genetic variation in life history traits. Northern and northernmost populations had a shorter larval development time and faster growth than central populations, implying local adaptations. Faster growth was also correlated with increased larval mortality, suggesting a fitness cost.

Buckland-Nicks A., K.N. Hillier, T.S. Avery and N.J. O'Driscoll. 2014. Mercury bioaccumulation in dragonflies (Odonata: Anisoptera): examination of life stages and body regions *Environmental Toxicology & Chemistry* 33(9): 2047–2054. As predators and prey in aquatic and terrestrial food webs, dragonflies are important in bioaccumulation of methylmercury. This study examined bioaccumulation in different body regions of dragonfly nymphs, adults, and exuviae from two lakes in Nova Scotia, Canada. Overall, mean mercury concentrations were lower in exuviae than in adults and nymphs. Abdomens of immatures and adults often had higher mercury concentrations than heads or thoraces; this was consistent across families, although overall aeshnids and corduliids had higher concentrations of mercury than gomphids and libellulids. This could result in different rates of exposure

for organisms that eat odonates, as some predators prefer to consume the highest-energy portions of their prey, such as the abdomen. The lower levels of mercury in exuviae indicate that in contrast to what has been observed for a few other insects, adults do not shed accumulated mercury at emergence, and thus both adult and nymphal dragonflies have a high potential for transferring accumulated mercury up the food chain.

Therry L., E. Lefevre, D. Bonte and R. Stoks. 2014. Increased activity and growth rate in the non-dispersive aquatic larval stage of a damselfly at an expanding range edge. *Freshwater Biology* 59(6): 1266–1277. Evolutionary changes in adult traits have been recorded for many species during range expansion, but similar changes in non-dispersing larvae have rarely been recorded. This study examined whether larvae of the range-expanding damselfly *Coenagrion scitulum* showed increased activity in edge populations in the Netherlands compared to core populations in France. Larvae from edge populations consistently showed higher activity and growth rate than core population larvae, and their respective activity levels did not differ significantly in the presence of a predator, submerged vegetation, or temperature changes. This difference in activity was not mirrored in adults. Higher larval activity may have additional impacts on related factors such as competition and prey community composition.

Bush A., V. Hermoso, S. Linke, D. Nipperess, E. Turak and L. Hughes. 2014. Freshwater conservation planning under climate change: demonstrating proactive approaches for Australian Odonata. *Journal of Applied Ecology* 51(5): 1273–1281. This study stresses the importance of maintaining connectivity among freshwater habitat reserves in the face of climate change. The modelled distribution of 126 odonate species in east Australia was used to identify reserve networks for current or future distributions. Resistance of odonates to climate change is predicted to be assisted by expanding protected areas as well as focusing on connectivity between catchments, although optimal strategies for different species will depend on their dispersal ability and the overall availability of climatic refugia.

Harabiš F. and A. Dolný. 2014. Necessity for the conservation of drainage systems as last refugia for the threatened damselfly species, *Coenagrion ornatum*. *Insect Conservation and Diversity* DOI: 10.1111/icad.12093. The endangered European damselfly *Coenagrion ornatum* (Ornate Bluet) was re-discovered in the Elbe Valley of the Czech Republic in 2001 after a gap of 40 years. It was found only at highly altered sites, and well-intended management practices led to local extinction of some populations as they did not account properly for species'


habitat preferences. This study analyzed habitat preferences by examining characteristics of 30 ditch segments in association with the presence or absence of *C. ornatum*. The species was found where the channel was smaller and warmer, with a diversity of aquatic vegetation, lower flow velocity, limited shading, and a silt or mud substrate without gravel or concrete. Results indicate that the disappearance of natural habitats for this species may be remediated by suitable artificial habitats such as drainage ditches; additional activities that may benefit the damselfly include removing vegetative overgrowth and not attempting to strengthen the stream bed.

**Culler L.E., M.A. McPeck and M.P. Ayres. 2014. Predation risk shapes thermal physiology of a predaceous damselfly. *Oecologia* 176(3): 653–660.** The risk of being eaten by a predator can alter prey behavior and habitat use and affect feeding and growth rates. This study investigated the effects of temperature and predation risk on the Vesper Bluet (*Enallagma vesperum*). In the absence of a fish predator, nymph growth rates increased with temperature up to 23.5°C, after which they declined. Growth rates were lower when a predator was present and the effects of temperature were less apparent. This study shows that the effects of climate change may differ in the presence of other environmental factors.

**Kietzka G.J., J.S. Pryke and M.J. Samways. 2014. Landscape ecological networks are successful in supporting a diverse dragonfly assemblage. *Insect Conservation and Diversity* DOI: 10.1111/icad.12099.** Ecological networks (ENs), comprised of landscape-scale corridors and nodes, are known to mitigate the impacts of agroforestry to terrestrial species, but their effects on aquatic species are unknown. This study examined the relative contributions of anthropogenic disturbance and natural environmental variables on odonate diversity in ENs. Although differences in response were seen between dragonflies and damselflies, overall species richness was significantly influenced by river width, water depth and turbidity, and presence of invasive plants, as well as flow rate and the type of water body and substrate. Natural environmental

variables had a stronger impact on diversity than anthropogenic disturbances, highlighting the important role of landscape heterogeneity at an appropriate local scale in ENs to maintain odonate biodiversity.

**Goertzen, D. and F. Suhling. 2014. Central European cities maintain substantial dragonfly species richness—a chance for biodiversity conservation? *Insect Conservation and Diversity* DOI: 10.1111/icad.12102.** Biodiversity in densely populated Central Europe has decreased, and conservation of semi-natural habitats is difficult and has had limited success. This study looked at the ability of urban habitats to conserve odonate diversity by comparing the odonate fauna of 30 cities (population >100,000) to the regional species pools in the surrounding landscape. Seventy-five of the 81 Central European species were found in cities, including 12 of 14 species of conservation concern (CC). On average, cities hosted 77% of the regional species pool. Ten CC were able to reproduce successfully in cities, and six were abundant in at least one city. While cities may be a sink for some species that occur regionally, the presence of reproductive populations of many species suggests that cities have high potential for conserving species richness, especially with focused conservation management practices.

**Mischianti M., H.-T. Lin, P. Herold, E. Imler, R. Olberg, and A. Leonardo. 2014. Internal models direct dragonfly interception steering. *Nature* DOI:10.1038/nature14045.** This study tracked the position and orientation of a dragonfly's head and body in flight as it moved to capture prey, to determine whether odonates can use the same internal predictive models that vertebrates are known to use to guide movement and the interception of a target. Videos of motion-capture studies revealed that dragonflies were not simply responding to moving prey; rather, they made structured turns and adjusted the orientation of their heads and bodies to enable interception of the prey, even if the prey's trajectory was not currently changing. These results indicate that dragonflies are capable of both reactive responses and more sophisticated predictive model-driven control during hunting. 

## Advice Column

“Do not store all of your Odonata data on a thumb drive. They are too easily lost!!!!”

*Kathy Biggs, California*

If you would like to share any words of wisdom about the many aspects of odonate life and life with odonates with your fellow enthusiasts, newcomers and experts alike, please don't hesitate! Send submissions for the Advice Column to the Editor at <celeste@xerces.org> and do your part to help make the world of odonates a better place.

## How I Fell Into the Clutches of the Odonata

This feature presents essays from DSA members that describe how, when, where, and why they first became interested in Odonata. It's also a fun way for members to find out a little more about each other. If you would like to contribute, write a short essay describing your first forays into the world of Odonata and how it has affected your life since, including your most interesting ode-hunting tale, and send it to the Editor at <celeste@xerces.org>. Whether you just discovered odonates this spring or have pursued them for decades, I know there are interesting, entertaining, and inspiring stories to tell. In this installment, Bill Flynt pays tribute to his mentor in the Odonata.

### How I Caught the Ode Bug

Bill Flynt, Roswell, New Mexico <flynt@plateautel.net>

I am not an "Ode Expert" by any means—but I know one.

I guess I am an 'advanced amateur' photographer and for 45 years my most interesting subjects were hummingbirds, followed up by anything beautiful I could find in nature, and photographing and flying hot air balloons with my wife, Suzi.

About nine years ago I started shooting Odes, just because they were beautiful and interesting, plus we seemed to have a lot of them around these parts. I live in Roswell, New Mexico and we have Bitter Lake National Wildlife Refuge only about seven miles outside of town. Bitter Lake and Bottomless Lakes State Park, about five miles south of Bitter Lake, offer over a hundred species of Odes.

I met Robert Larsen through his volunteer work for the wildlife refuge here in Chaves County and he is the one who really got me interested in Odes. I had photographed 16 of the 17 hummingbirds that nest in the United States and enjoyed shooting Odes because they were so beautiful. When I learned how many species we have here I was enthralled and started learning about them. Robert gladly answered all my questions (he still does) and encouraged my odonate photography. He says he loves looking at pictures. It was after several years of friendship that I learned he could spout off the scientific name of any plant (or




Robert Larsen (left) showing Bill Flynt (right) a dragonfly in hand. Photo by Clifford Powell.)

Ode—and probably any other creature) in the area and I realized that he didn't know just about Odes. Robert is very smart. Sometimes when we are giving a presentation (with my pictures and his knowledge) he'll tell me beforehand "Help me out if I start stumbling" and I tell him if I just knew as much as he has forgotten, I would be an expert too.

Robert is an amazing guy. He is a retired biologist, and used to illustrate plants, etc. for a living. His dad studied Odes in Utah when Robert was a child (Larsen, W.P. 1952. The dragonflies (Anisoptera) of Utah, unpublished MS Thesis, Department of Zoology, University of Utah, 95 pp.). Robert's mother would send him out to 'help' his dad when he was working out in the field because Robert was very 'active' and would wear his Mother out.

I guess this is more about Robert than about me, but that's O.K. See "Getting Hooked on Odonates in Three Easy Steps" by James N. Stuart in the 15 June 2014 issue of ARGIA and you will see what I'm talking about. Plus, Robert is a great guy.

I still shoot hummingbirds and hot air balloons, but Odes are my main subjects now. 

### "Thank you!" from your Editor

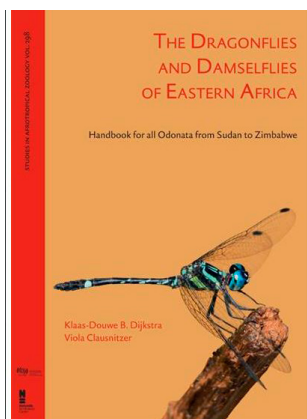
As we reach the end of another year of ARGIA issues, I want to extend my sincere thanks to all of you who gave your time and effort to the journal in the form of articles, essays, species lists, and photos. Your contributions make ARGIA an informative, entertaining, and eye-catching publication. And thanks to Jim Johnson for being ARGIA's fearless proofreader!



## New Book Announcements

**The Dragonflies and Damselflies of Eastern Africa: Handbook for all Odonata from Sudan to Zimbabwe.** Dijkstra, K.-D. and V. Clausnitzer. Belgian Royal Museum for Central Africa, 264 pp. Paperback £23.50. ISBN 97894916165061


From the publisher's web site: Few animal groups can represent the greatest (insects) and most threatened (freshwater) biodiversity on earth as well as dragonflies, perhaps the best-known and most colourful of all aquatic insects.



Fifteen years in development, The Dragonflies and Damselflies of Eastern Africa is the first handbook of its extent and detail on tropical Odonata. Extending from Sudan and Somalia to Zambia and Mozambique, including the entire eastern half of the Congo Basin, the book covers a third of Africa, about ten million square

kilometres, an area comparable to China or the United States, but treats almost two-thirds of the continent's species. More than 500 species are illustrated with 1120 original drawings and over 360 colour photographs portraying 320 species. Identification keys to adult males of all species set a new standard for recognising 'the bird-watcher's insects' in Africa, detailed genus descriptions provide the most comprehensive account of their ecology and taxonomy so far, and all species have been furnished with a vernacular English name for the first time. Verified checklists are presented for Democratic Republic of Congo, Ethiopia, Kenya, Malawi, Mozambique, Rwanda, Somalia, South Sudan, Sudan, Tanzania, Uganda, Zambia and Zimbabwe.

**Where to Find Damselflies and Dragonflies in the Cayuga Lake Region and the Vicinity.** Meena Haribal. Published by the author, 165 pp. Paperback \$17.50 plus tax; eBook \$10.50. For ordering information contact the author at <mmh3@cornell.edu>. ISBN 978-1-4951-1641-4.

Illustrated with more than 400 photographs of over 100 species found in the region. Reviewed in this issue. 

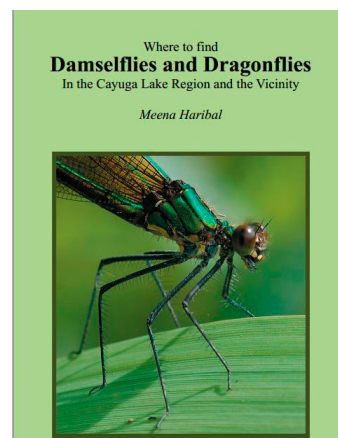
## Book Review: Where to Find Damselflies and Dragonflies in the Cayuga Lake Region and the Vicinity


**Thomas W. (Nick) Donnelly** <tdonnelly@binghamton.edu>

Meena Haribal is a chemical ecologist working with the Boyce Thompson Institute for Plant Research. For the past several years we have often been in touch regarding local odonates (I live in Binghamton, just beyond the area covered by her book.). She has produced what I regard as a "thinking person's guide to dragonflies". She states that this is not a guide, but you could have fooled me. Devoting a page or more to each species and illustrating each species with excellent photographs, she has produced a book which is very much the equal of many contemporary books which are only guides to identification. It will serve handsomely to identify odes in central upstate New York, and in fact the bulk of the northeastern United States.

The main interest of the book for me, and I suspect for many others, is the continuous interjection of simple but compelling observations on odonate behavior. Following the text, the reader is constantly confronted with ques-

tions raised by her observations. She invites readers not just to look at and enjoy odonates, but to ask their own questions about their physiology and behavior. Having been at it myself for more than 65 years, I learned many things, and I have no doubt that others will do likewise.



If you are interested in more than just attaching names to odes and making a list, I believe you will find this book very rewarding, and I strongly recommend it. 

## Parting Shots

Parting Shots pays tribute to the endless diversity and interest of odonate behaviors and the skilled photographers among us, with an additional nod to the many unexpected (and sometimes downright silly) ways in which odonates can creep into daily life. If you have photos that showcase some odd, bizarre, unusual, unexpected, or amusing aspect of odonate life (or of life with odonates), please send them to the Editor at <celeste@xerces.org>, along with a short note describing the photo and event.

### Cryptic Coloration

Jim Burns <jpbaztec@aol.com>

In my admittedly brief and unscientific three year odeing career, I've seen many Red Rock Skimmers (*Paltothermis lineatipes*), probably upwards of a hundred, because I live in the center of the species' range. However, only three of these sightings have been females. Dennis Paulson, in his two volume "bible", mentions that the females of several different species are seldom seen. I've often wondered why.

This past October, while observing only my third-ever female Red Rock Skimmer, I got a clue, at least in regard to this particular species. I was in one of my favorite ode haunts, a south-facing canyon on the southern slope of Arizona's Huachuca Mountain range. A creek runs down



Red Rock Skimmer (*Paltothermis lineatipes*) female, Cochise County, Arizona, October 2014. Photo by Jim Burns.



Red Rock Skimmer (*Paltothermis lineatipes*) male on red rock, Cochise County, Arizona, July 2013. Photo by Jim Burns.

the canyon, which opens up into Mexico, and typically hosts a wide variety of odes and the tantalizing prospect of vagrants from south of the border.

Monsoon rains in southeastern Arizona this past summer, however, were well above average, and most of the watersheds there have been scoured of vegetation. Presumably because of this I found few odes flying, so when I discovered the Red Rock Skimmer female I was able to hang out and observe her without distraction for almost an hour as she prospected through the canyon, landing many times, never in the same place.

It finally dawned on me that, without exception, she always landed vertically on small bushes or dead grasses. Running through my mental rolodex of sightings past, I realized the other two females I'd observed had done the same thing, but all those many Red Rock males I'd encountered had also and without exception always landed horizontally on rocks, frequently but not always red rocks.

So Dennis had, as usual, assigned the perfect common name to this species, but more interesting is the fact that a definite and gender-specific cryptic coloration seems at play in Red Rock Skimmers. The female, with her ecru and ivory background color cross-hatched by dark browns and blacks, only hangs up and this only against a background of dark twigs and washed-out stems, themselves on a backdrop of mottled shadow and light. Conversely the male, with his brick red background color, only lands flat and this only on streambed rocks, themselves cross hatched with striations of dark cracks and mineral stains which match his dark cross hatching.

As a lifetime birder, I know well that camouflage works to keep birds safe. They are procrystic. Now I see that this probably is at work for some dragons and damsels as well. So far I have not seen anything in the literature about this but, incidentally, the photo of the female Red Rock Skimmer in Dennis' western odonates book is flat on a rock. Not to negate the theory, though, she is labelled "posed." Fascinating stuff. Wish I were a scientist.

### Two County Records for the Price of One

Leslie Flint <lfint@earthlink.net>

In mid-October 2014, just after Steve Rovell reported a first record of Autumn Meadowhawk (*Sympetrum vicinum*) for Calaveras County, California, Leslie headed to the same place to see if she could find some of the meadowhawks to photograph. Her resulting image was photobombed by a Great Spreadwing (*Archilestes grandis*)—a fortunate happenstance, as the spreadwing turned out to be a county record as well!



### Objects in the Binoculars are Larger Than They Appear

Buck Snelson <ffbs3474@gmail.com>

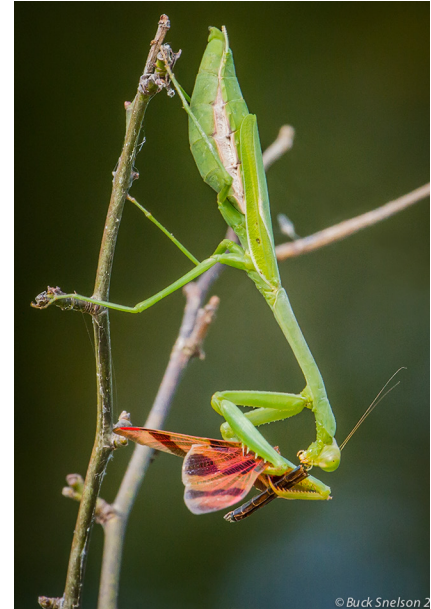
An encounter between Buck's wife, Margaret Flagg, and an outside odonate at the Airlie Gardens in Wilmington, North Carolina, 12 September 2014. This specimen was not collected!



### Predator vs. Predator

Buck Snelson <ffbs3474@gmail.com>

Buck Snelson's photo of a Praying Mantis consuming the business end of a Halloween Pennant (*Celithemis eponina*) in Yorkton, Virginia, reminds us that not all predators are created equal...



### Odd Couple

Rick Nirschl <ricknir@hotmail.com>

Rick caught this unexpected pairing of a male Common Green Darner (*Anax junius*, upper) and male Green-striped Darner (*Aeshna verticalis*, lower) on 21 September 2014 at the Magee Marsh Wildlife Area in Toledo, Ohio.



### Three's a Crowd

Jim Reber <jcreber43@gmail.com>

Jim sends us an illustration of the fact that male dragonflies can be quite aggressive towards mating pairs. While out with his camera in Indiana, Pennsylvania in July 2013, trying to get good photos of mating pairs of Eastern Pondhawks (*Erythemis simplicicollis*) against attractive backgrounds, he found this trio—not the most beautiful background, perhaps, but an interesting behavior capture!



### And the Pondhawk Aggression Continues...


Ron Oriti <meteoriti@aol.com>

Ron caught this photo of a Western Pondhawk (*Erythemis collocata*) chowing down on a Variegated Meadowhawk (*Sympetrum corruptum*) on 30 July 2013. There's one meadowhawk that won't be migrating south!



### Spying the Spot-wings

Ron Oriti <meteoriti@aol.com>

How many Spot-winged Gliders (*Pantala hymenaea*) can you count in this photo? Another of our North American migratory species, these gliders like to perch while hanging at an angle or nearly vertically. These “odes of a feather perching together” are well-camouflaged against the surrounding vegetation—there are a lot more of them than initially meet the eye! 



### Photo Submissions for ARGIA

If you would like to contribute a photo as a possible front or back cover “glamour shot” for ARGIA, please contact the Editor at <celeste@xerces.org>. We need high-quality images in TIFF or JPEG format with a resolution of 300 ppi at about 6.5 inches in width; please check the resolution before sending. Photos that lack sufficient resolution to be reproduced at the larger cover size but show an interesting behavior or specimen may be suitable for Parting Shots.

Photos can be sent as e-mail attachments (up to 15 Mb), via a file transfer service, or in GoogleDrive. Submitted photos may be saved for later issues, but they will never be used for other purposes than ARGIA or sent to other individuals to use. If more than a few months have passed since a photo was submitted, the Editor may contact you to be sure that it's still OK to use the image. Please include metadata, including date and location (state and county at minimum), when submitting a photograph!

## **Odonates Are All Over Facebook!**

Those of you who enjoy staying connected via social media will be happy to know that the number of odonate-specific Facebook Group pages is burgeoning. In addition to the DSA Facebook page, you can connect with fellow ode enthusiasts via FB groups with broad regional coverage, such as Western Odonata, Northeast Odonata, Southeastern Odes, and the Migratory Dragonfly Partnership, as well as more regionally-focused groups such as the Minnesota Dragonfly Society, Odonata Ohio, and the Wisconsin Dragonfly Society. Another FB group simply called Dragonflies has world-wide coverage and provides the opportunity to see species from Africa, Europe, and Thailand. and the British Dragonfly Society has a page as well.

To find these groups, just type the name into the search bar at the top of your Facebook page. The discussions are lively, friendly, and highly educational! If I have missed any Facebook sites you would like to see included in further announcements, please let me know at <celeste@xerces.org>.

## **Correction**

The caption for the image on pg. 36 of the previous issue of ARGIA (26: 3) in Parting Shots states that an Eastern Pondhawk is being eaten by an Argiope spider. The spider's victim is in fact a female spreadwing, species unknown. Thanks to Dennis Paulson for pointing out the error. The editor is still face-palming over this particular oversight...

## **ARGIA and BAO Submission Guidelines**

Digital submissions of all materials (via e-mail or CD) are vastly preferred to hardcopy. If digital submissions are not possible, contact the Editor before sending anything. Material for ARGIA should be sent to Celeste Mazzacano, The Xerces Society for Invertebrate Conservation, 628 NE Broadway, Suite 200, Portland, Oregon, USA 97232, <celeste@xerces.org>. Material for BAO must be sent to Steve Hummel, Lake View, Iowa, USA 51450, <mshummel@iowatelecom.net>.

### **Articles**

All articles and notes should be submitted in Word or Rich Text Format, without any figures or tables or their captions, embedded. Please submit all photos and figures as separate files along (see Figures below). Only minimal formatting to facilitate review is needed—single column with paragraph returns and bold/italic type where necessary. Include captions for all figures and tables in a separate Word or Text document.

Begin the article with title, author name(s), and contact information (especially e-mail) with a line between each. The article or note should follow this information. Paragraphs should be separated by a line and the first line should not be indented. Where possible always give both the scientific name of a species as well as its official common name in parentheses.

### **Figures**

Submit figures individually as separate files, named so that each can be easily identified and matched with its caption. Requirements vary depending on the type of graphic.

Photographs and other complex (continuous tone) raster graphics should be submitted as TIFF (preferred) or JPEG files with a minimum of 300 ppi at the intended print size. If unsure about the final print size, keep in mind that over-sized graphics can be scaled down without loss of quality, but they cannot be scaled up without loss of quality. The printable area of a page of ARGIA or BAO is 6.5 × 9.0 inches, so no graphics will exceed these dimensions. Do not add any graphic features such as text, arrows, circles, etc. to photographs. If these are necessary, include a note to the Editor with the figure's caption, describing what is needed. The editorial staff will crop, scale, sample, and enhance photographs as deemed necessary and will add graphics requested by the author.

Charts, graphs, diagrams, and other vector graphics (e.g. computer-drawn maps) are best submitted in Illustrator format or EPS. If this is not possible, then submit as raster graphics (PNG or TIFF) with a minimum of 600 ppi at the intended print size. You may be asked to provide the raw data for charts and graphs if submitted graphics are deemed to be unsatisfactory. When charts and graphs are generated in Excel, please submit the Excel document with each chart or graph on a separate sheet and each sheet named appropriately (e.g. "Fig. 1", "Fig. 2", etc.)

### **Tables**

Tables may be submitted as Word documents or Excel spreadsheets. If Excel is used, place each table on a separate sheet and name each sheet appropriately (e.g. "Table 1", "Table 2", etc.)

# The Dragonfly Society Of The Americas

Business address: Celeste Mazzacano, The Xerces Society for Invertebrate Conservation, 628 NE Broadway, Suite 200, Portland, Oregon, USA 97232

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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. Membership in DSA includes a digital subscription to 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.

## Membership in the Dragonfly Society of the Americas

Membership in the DSA is open to any person in any country and includes a digital subscription to ARGIA. Dues for individuals in the US, Canada, or Latin America are \$15 us for regular memberships (including non-North Americans), institutions, or contributing memberships, payable annually on or before 1 March of membership year. 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. Membership dues and BAO subscription fees should be mailed to Jerrell Daigle, 2067 Little River Lane, Tallahassee, Florida, USA 32311. More information on joining DSA and subscribing to BAO may be found at <[www.dragonflysocietyamericas.org/join](http://www.dragonflysocietyamericas.org/join)>.

**Back cover: (upper)** Sandhill Clubtail (*Gomphus cavillaris*), Ocean Pond, Osceola National Forest, Baker County, Florida, April 2014. Photo by Chris Hill. **(lower)** Ovipositing spreadwing (*Lestes*), Amboy Marsh Wildlife Sanctuary, Lee County, Illinois, 20 August 2014. Photo by Dick Todd.

