ISSN 1061-8503

ARGIA

The News Journal of the Dragonfly Society of the Americas

Volume 27 20 September 2015 Number 3

Published by the Dragonfly Society of the Americas
http://www.DragonflySocietyAmericas.org/

ARGIA Vol. 27, No. 3, 20 September 2015

Front cover: Male Blue-winged Helicopter Damselfly (*Megaloprepus caerulatus*), La Selva Biological Station, Costa Rica, 29 May 2015. Photo by Steve Valley.

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

DSA Holds its First-Ever Regional Meeting in Costa Rica, 1–8 June 2015

Celeste A. Searles Mazzacano <cmazzacano@gmail.com>

On Sunday 31 May, 2015, 33 DSA members gathered at the Hotel Bougainvillea in San José to kick off an Odonata odyssey through Costa Rica, with field sites centering on two research stations of the Organization for Tropical Studies (La Selva and Palo Verde) plus numerous stops along the way at streams, wetlands, and waterfalls. The trip was organized through the dedicated efforts of Marla Garrison and ably led by Dennis Paulson, who created the first odonate photo field guide for Costa Rica specifically for this gathering. And, despite a trip to the emergency room in San José and an encounter with fire ants that left him temporarily pants-less, our indefatigable leader's enthusiasm never waned! The group was also joined by Bill Haber, who generously shared his expertise from living and working in Costa Rica for many years studying the odonate fauna. The trip coincided with the beginning of Costa Rica's rainy season, when odonate abundance and diversity are on the rise, but the rains aren't yet so intense as to make for poor dragonfly viewing. It was hoped we would be early enough in the rainy season to avoid the worst of the mosquitoes, but not all wishes, alas, come true…

Staurophlebia reticulata (Magnificent Megadarner), Parque Nacional Carara, 25 May 2015. Photo by Marla Garrison.

Some participants arrived early to go birding or ode-ing on their own and some stayed late to explore even more of the country. Our meeting place at the Hotel Bougainvillea not only provided a good jumping off point (and a chance for participants to experience their first of many, many meals of gallo pinto, the traditional Costa Rican breakfast of rice and beans), its extensive gardens and frog ponds provided some of the first ode sightings of the trip. We loaded onto our bus on the morning of Monday 1 June and wended our way northwards towards La Selva. The journey was punctuated by a constant symphony of bird names cried aloud by keen observers gazing intently at the sides of the road—a chorus that would accompany every drive. Our first official stop was at Parque Nacional Braulio Carrillo, Sector Quebrada González. This site yielded several interesting ode species that were novel to most of the group, but our search for insects was temporarily derailed by the first sight that met our wondering eyes—a mother and baby three-toed sloth moving languidly in a tree high above us. We finally tore ourselves away from this arresting and iconic sight and dispersed along various trails and small streams, encountering species such as White-faced Flatwing (*Heteragrion albifrons*), Wispy Threadtail (*Psaironeura* n. sp.), and Elongate Shadowdamsel (*Palaemnema gigantula*).

We continued on from the park to La Selva Biological Station, located in the Caribbean lowlands at the confluence of the Puerto Viejo and Sarapiquí rivers, with an abundance of tropical and premontane wet forest habitat. Although heavy rainfall caused repeated flooding of the station the week after our departure, we were fortunate to experience only a few afternoon rains in our time there—just a small taste of the 4 m (13 ft) that falls in this area annually. We were welcomed to the station by director Carlos de la Rosa (who, along with Bill Haber, recently published a description of a new dragonfly species found at the

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Calendar of Events

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

Event	Date	Location	Contact
DSA SE Meeting	early April, 2016	Alexandria, Louisiana	Bill Mauffray <iodonata@gmail.com>
DSA Annual Meeting	15–17 July, 2016	Provo, Utah	to be determined
Int. Congress of Entomology	25–30 Sept. 2016	Orlando, Florida	S. Büsse <sbuesse@zoologie.uni-kiel.de>

continued from previous page...
station, *Erythrodiplax laselva,* quite unusual among dragonflies for breeding in bromeliads) and had our first encounters with both the resident howler monkeys that would serenade us daily and the local herd of peccaries.

Over the next few days at La Selva, we spent the early mornings breakfasting at the open-air dining hall while watching myriad brilliantly colored birds flickering in and out of the trees, then divided into small groups that strode off resolutely into the gathering heat and humidity to visit different parts of the reserve on La Selva's 35 miles of trails. These groups returned in the afternoons, muddy and sweat-soaked, to gulp electrolytes and compare stirring tales and photos. In the evenings we collapsed gratefully in the air-conditioned meeting room to detail our sightings to Chris Hill, who volunteered to be the trip's official Keeper of the Species List.

Daily sightings included evocative species such as Shadowy Leafsitter (*Oligoclada umbricola*), Golden Amberwing (*Perithemis electra*), Broad-striped Forceptail (*Aphylla angustifolia*), Spinebellied Dryad (*Nephepeltia phryne*), Armed Knobtail (*Epigomphus armatus*), and Magnificent Megadarner (*Staurophlebia reticulata*), a species Dennis claimed in his guide would lift us off of our feet if caught in our nets. Indeed, this was hardly an exaggeration. Traipsing up small streams guided by lazy blue morpho butterflies, we were rewarded with sightings of *Epigomphus* (knobtails), *Elasmothemis* (streamskimmer), *Heteragrion* (flatwings), and needle-thin, secretive *Psaironeura* (threadtails). Along the edges of larger streams we encountered additional spectacular *Protoneura* and *Neoneura* threadtails, not to mention plentiful, diverse, frustratingly similar species of *Argia* (dancers) and of *Hetaerina* (rubyspots). In the swampy areas and temporary pools, a multitude of *Micrathyria* (dashers), *Cannaphila* and *Orthemis* skimmers, *Anatya guttata* (Common Blue-eye), and *Uracis* (woodskimmer) species were to be found. The gorgeous

Argia oenea (Fiery-eyed Dancer) pair, Catarata Llanos de Cortez, Guanacaste Province, 7 June 2015. Photo by Netta Smith.

Male of undescribed Amberwing species (*Perithemis sp. nov.*) at La Selva, 2 June 2015. Photo by Pierre Deviche.

Hetaerina cruentata (Highland Rubyspot), 4 June 2015, stream near Arenal Observatory Lodge. Photo by Nancy McIntyre.

Gynacantha tibiata (Gold-tipped Darner) flew along trails, occasionally hanging up like a rainbow beneath the dark canopy.

In addition to this array, for many the true Holy Grail of the trip was a glimpse of *Megaloprepus* and *Mecistogaster*—the amazing helicopter damselflies. These damsels are noteworthy for many reasons—the broad span of their shimmering white-, blue-, or lemon-yellow tipped wings (up to 7.5 in. [19 cm]); their use of phytotelmata, i.e. water-filled plant cavities such as tree holes, fallen logs, and bromeliads, as oviposition sites; their specialization in preying on spiders plucked from their webs; and their lazily spiraling flights up through sunlit forest clearings. Their reliance on forest habitat, a trait shared with a large proportion of Costa Rica's odonate species, puts populations at risk due to ongoing deforestation and habitat fragmentation. La Selva's protected forests did not disappoint, with multiple sightings of Bromeliad Helicopter (*Mecistogaster modesta*), Long-tailed Helicopter (*M. linearis*), and Blue-winged Helicopter (*Megaloprepus caerulatus*). Another notable find was an as-yet undescribed

species of Amberwing (*Perithemis sp. nov.*). Our group photographed multiple males and observed one female.

Our next destination was the Palo Verde field station in northwestern Costa Rica, a long trip divided across two days. On 4 June the group headed west from La Selva towards Volcán Arenal, an active volcano that still emits wisps of smoke from its cone. Along the way we made a lunch stop at the appropriately lizard-festooned Restaurante Las Iguanas, and paused to look for odes at a few small rivers. These stops yielded mostly damselflies, including multiple rubyspots (*Hetaerina*) and dancers (*Argia*). We stopped for the evening at the Arenal Observatory Lodge, where we appreciated both the relative coolness of the higher elevation and the pleasant music of tiny hidden frogs that filled the night with their bright "tink, tink" calls.

On 5 June we continued our westward journey, fortifying ourselves with a stop at a somewhat unexpected German bakery, and diverting ourselves during the final jolting ride along rutted dirt roads with sightings of about 30 different bird species. A lunch stop in the small town of Cañas left us reeling from the dry sweltering heat, proof that we had crossed into an altogether different ecozone. In the afternoon we arrived at Palo Verde, located in the Pacific lowlands of Guanacaste Province in northwestern Costa Rica and encompassing deciduous dry forest, a large freshwater marsh, and extensive wetlands bordering the Río Tempisque. Due to a protracted drought, the large marsh was almost completely dry, but we all realized within the first few moments of exiting the bus that there had recently been sufficient rain for the first hatch of mosquitoes to emerge as hungry adults—an event which precedes the annual emigration of dragonflies from their dry-season refugia into the park. If there is a Valhalla for odes, it must be Palo Verde during the rainy season. We received our orientation to the station (the highlight of which was being warned about the perils of scorpions, pit vipers, and Africanized bees), and with the advent of a heavy rainstorm, dispersed to our respective bunkhouses.

Micrathyria ocellata (Square-spotted Dasher) male, La Selva, 2 June 2015. Photo by Netta Smith.

Epigomphus armatus (Armed Knobtail) male, La Selva, 2 June 2015. Photo by Celeste A. Searles Mazzacano.

During the next few days, groups dispersed along the roads and into the marsh on ode-hunting forays made somewhat shorter than usual by the large numbers of mosquitoes, which didn't so much swarm as form a dense suspension in the air. An abundance of circling Great Pondhawks (*Erythemis vesiculosa*) treated us as a sort of mobile mosquito buffet, but their valiant efforts couldn't make a perceptible dent in the populations. However, we still added several new species for the trip at this site, including Black and Pin-tailed Pondhawks (*Erythemis attala* and *E. plebeja*), Black-winged Dragonlet (*Erythrodiplax funerea*), and Pale-green Darner (*Triacanthagyna septima*), and the insect diversity at the station's moth sheet was the focus of many nocturnal expeditions. In addition to families of white-faced capuchins and coatimundi, a harrowing 4.5 mile hike to the Tempisque River also turned up *Telebasis isthmica* (Green-eyed Firetail). On 7 June we ventured further afield to nearby parks including Lomas Barbudal and the Catarata Llanos de Cortes, a refreshing waterfall and popular swimming hole for the local Ticos, whose Sunday afternoon was enlivened by the spectacle of DSA-ers prowling through the water for nymphs.

On Monday 8 June, it was time to wrap up the trip and head back to San José. A long day's drive southward down the coast provided an opportunity to stop at the bridge over the Río Grande de Tarcoles, where piles of crocodiles slumped in prehistoric indolence along the muddy shores. We stopped later at a terrific seafood restaurant along the coast that Bryan Pfeiffer had discovered during his pre-trip travels, and spent a while exploring the ocean beach and photographing the clouds of butterflies visiting the restaurant's zinnia plantings. Another long stretch brought us full circle back to Hotel Bougainvillea, for a final group dinner filled with conversations about what was, for most of us, the trip of a lifetime—"pura vida" at its finest. A total of 96 species was observed during the trip proper, (44 damselflies and 52 dragonflies) with 15 additional species reported by group members traveling before and after the official trip dates, for a grand total of 111 species. A complete list follows this report (note: John Abbott encourages trip participants to submit their records to OdonataCentral!).

DSA Costa Rica species list. Superscripts indicate location(s) sighted. 1 = Parque Nacional Braulio Carillo; 2 = La Selva; 3 = trip to Volcan Arenal; 4 = Parque Nacional Palo Verde; 5 = Lomas Barbudal; 6 = Catarata Llanos de Cortes. Species with an asterisk are new for La Selva. Pre- and post-meeting additions not seen during the regular trip are listed at the end.

ZYGOPTERA (DAMSELFLIES)

Spreadwings (Lestidae)
Blue-striped Spreadwing (*Lestes tenuatus*)[2]
Tikal Spreadwing (*L. tikalus*)[2]

Shadowdamsels (Platystictidae)
Carrillo Shadowdamsel (*Palaemnema distadens*)[1]
Elongate Shadowdamsel (*P. gigantula*)[1]
Black-tipped Shadowdamsel (*P. paulirica*)[2]
Nathalia Shadowdamsel (*Palaemnema nathalia*)[2,5,6]

Broad-winged Damsels (Calopterygidae)
River Rubyspot (*Hetaerina caja*)[5,6]
Highland Rubyspot (*H. cruentata*)[3]
Redstripe Rubyspot (*H. miniata*)[2,3]
*Racket-tipped Rubyspot (*H. occisa*)[2,3]
Smoky Rubyspot (*H. titia*)[2]

Bannerwings (Polythoridae)
Peralta Cora (*Miocora peraltica*)[1]

Flamboyant Flatwings (Heteragrionidae)
White-faced Flatwing (*Heteragrion albifrons*)[1]
Red-and-black Flatwing (*H. erythrogastrum*)[2,5,6]

Dusky Flatwings (Philogeniidae)
Costa Rican Flatwing (*Philogenia carrillica*)[1]

Pond Damsels (Coenagrionidae)
Costa Rican Wedgetail (*Acanthagrion speculum*)[2]
*Pacific Wedgetail (*A. trilobatum*)[2,4,5,6]
Varied Dancer (*Argia adamsi*)[2]
*Ruby Dancer (*A. cupraurea*)[2]
Spine-tipped Dancer (*A. extranea*)[3]
Green-eyed Dancer (*A. frequentula*)[2,3]
Swamp Dancer (*A. indicatrix*)[2]
Juan Viñas Dancer (*A. johannella*)[3]
*Familiar Dancer (*A. oculata*)[2,6]
Fiery-eyed Dancer (*A. oenea*)[5,6]
Pocomana Dancer (*A. pocomana*)[6]
Stream-swamp Dancer (*A. popoluca*)[3]
Purple Dancer (*A. pulla*)[5,6]
Dusky Dancer (*A. translata*)[2,5,6]
Neotropical Bluet (*Enallagma novaehispaniae*)[2,3,4,6]
Tiny Forktail (*Ischnura capreolus*)[3]
Rambur's Forktail (*I. ramburii*)[3,4]
Long-tailed Helicopter (*Mecistogaster linearis*)[2]
Bromeliad Helicopter (*M. modesta*)[2]
Blue-winged Helicopter (*Megaloprepus caerulatus*)[2]
Amelia's Threadtail (*Neoneura amelia*)[2,5,6]
Esther's Threadtail (*N. esthera*)[5,6]
Crimson Threadtail (*Protoneura amatoria*)[2,6]
Orange-and-black Threadtail (*P. aurantiaca*)[2]
Sulfury Threadtail (*P. sulfurata*)[2]
Wispy Threadtail (*Psaironeura* n. sp.)[1,2]
Marsh Firetail (*Telebasis digiticollis*)[2]
Green-eyed Firetail (*T. isthmica*)[4]
**Telebasis* sp. nr. *collopistes* (only seen, ID tentative)[2]

Telebasis isthmica (Green-eyed Firetail), Palo Verde, 6 June 2015. Photo by Pierre Deviche.

Argia translata (Dusky Dancer) female with mites on thorax, 26 May 2015. Photo by Steve Valley.

ANISOPTERA (DRAGONFLIES)

Darners (Aeshnidae)
Amazon Darner (*Anax amazili*)[4]
Fiery Darner (*Coryphaeschna diapyra*)[2]
Auricled Darner (*Gynacantha auricularis*)[2]
Dark-saddled Darner (*G. membranalis*)[1]
Twilight Darner (*G. nervosa*)[4,6]
Gold-tipped Darner (*G. tibiata*)[2]
Magnificent Megadarner (*Staurophlebia reticulata*)[2]
Pale-green Darner (*Triacanthagyna septima*)[4]

Clubtails (Gomphidae)
Broad-striped Forceptail (*Aphylla angustifolia*)[2]
Obscure Forceptail (*A. tenuis*)[2]

Armed Knobtail (*Epigomphus armatus*)[2]
Lowland Knobtail (*E. tumefactus*)[1]
Tuxtla Leaftail (*Phyllogomphoides pugnifer*)[2]

Skimmers (Libellulidae)
Common Blue-eye (*Anatya guttata*)[2]
Gray-waisted Skimmer (*Cannaphila insularis*)[2]
Morton's Skimmer (*C. mortoni*)[2]
Blue-eyed Setwing (*Dythemis nigra*)[2,5,6]
Brown Setwing (*D. sterilis*)[5,6]
Golden Streamskimmer (*Elasmothemis cannacrioides*)[2,5]
Black Pondhawk (*Erythemis attala*)[4]
Red Pondhawk (*E. haematogastra*)[2]
Pin-tailed Pondhawk (*E. plebeja*)[4]
Great Pondhawk (*E. vesiculosa*)[3,4,5,6]
Andagoya Dragonlet (*Erythrodiplax andagoya*)[2]
Red-mantled Dragonlet (*E. fervida*)[2,3]
Black-winged Dragonlet (*E. funerea*)[4]
Red-faced Dragonlet (*E. fusca*)[2,3]
Band-winged Dragonlet (*E. umbrata*)[2,4]
Silver-sided Skimmer (*Libellula herculea*)[2]
Three-striped Sylph (*Macrothemis hemichlora*)[2]
Jade-striped Sylph (*M. inequiunguis*)[2]
Hyacinth Glider (*Miathyria marcella*)[4]
Black Dasher (*Micrathyria atra*)[2]
Even-striped Dasher (*M. dictynna*)[2]
Three-striped Dasher (*M. didyma*)[4]
Fork-tipped Dasher (*M. mengeri*)[2]
Square-spotted Dasher (*M. ocellata*)[2]
Spine-bellied Dryad (*Nephepeltia phryne*)[2]
Shadowy Leafsitter (*Oligoclada umbricola*)[2]
Leafsitter (*Oligoclada* sp.)[5]
Swamp Skimmer (*Orthemis cultriformis*)[2]
Carmine Skimmer (*O. discolor*)[2]
Roseate Skimmer (*O. ferruginea*)[4]
*Slender Skimmer (*O. levis*)[2,4,5,6]
Wandering Glider (*Pantala flavescens*)[3,4,6]
Golden Amberwing (*Perithemis electra*)[2]
Plain Amberwing (*P. mooma*)[4]
Amberwing (undescribed) (*Perithemis sp. nov.*)[2]
Evening Skimmer (*Tholymis citrina*)[4,5]
Striped Saddlebags (*Tramea calverti*)[2,4,5,6]
Large Woodskimmer (*Uracis fastigiata*)[2]
Common Woodskimmer (*U. imbuta*)[2]

DSA Regional Meeting participants at Arenal Observatory Lodge (Volcán Arenal in background). Front row: Mark Donnelly, Bill Haber, Netta Smith, Dennis Paulson, Deb Mikasser, Pam Hunt, RT Cox, Celeste Searles Mazzacano, Nancy McIntyre, Jeri Ledbetter, Pierre Deviche, Dany Deviche, Madison Chudik. Back row: Steve Valley, Michael Drake, Justin Jones, Cary Kerst, Tom Schultz, Wade Worthen, Veta Bonnewell, Emily Khazan, Chris Hill, Stick LaPan, Bryan Pfeiffer, Laura Gaudette, Josh Lincoln, Ann Cooper, Lorena Krenitsky, Mark Krenitsky, Carroll Perkins, Nan Wilson, Larry Stevens, Marla Garrison

Species seen pre- and post-meeting that were not observed during the regular meeting

Bronze Rubyspot (*Hetaerina capitalis*), Rancho Naturalista, D. Paulson and N. Smith
Dot-winged Rubyspot (*H. fuscoguttata*), Piro Research Station, T. Schultz
Chirripó Cora (*Cora chirripa*), Monteverde, B. Pfeiffer, L. Gaudette, J. Lincoln
Cora sp. nov., Rancho Naturalista, D. Paulson and N. Smith
Blue Flatwing (*Philogenia peackocki*), Monteverde, B. Pfeiffer, L. Gaudette, J. Lincoln
Cerulean Dancer (*Argia anceps*), Hotel Bougainvillea (many)
Terira Dancer (*A. terira*), Río Saavegre Valley, P. Hunt, L. LaPan, L. and M. Krenitsky
Olmec Dancer (*A. ulmeca*), Rancho Naturalista, D. Paulson and N. Smith
Yellow-tipped Helicopter (*Mecistogaster ornata*), Piro Research Station, T. Schultz
Black-tailed Darner (*Rhionaeschna jalapensis*), Suria Lodge, P. Hunt, L. LaPan, L. and M.. Krenitsky
Turquoise-tipped Darner (*R. psilus*), Hotel Bougainvillea, D. Paulson and N. Smith
Masked Clubskimmer (*Brechmorhoga pertinax*), near San Martin, Alajuela Province, M. Garrison
Rapacious Clubskimmer (*B. rapax*), Rancho Naturalista, D. Paulson and N. Smith
Chalk-marked Dragonlet (*Erythrodiplax kimminsi*), Río Chires, San Jose province, C. Kerst
Northern Redskimmer (*Rhodopygia hinei*), Quebrado Bartalo, Puntarenas, C. Kerst

Acknowledgements

Thanks to Dennis Paulson and Marla Garrison for their input and review of this article. Thanks also to Veta Bonnewell for sending me a detailed route map that made writing this article much easier.

Field Observations From the 2015 DSA Annual Meeting in Central Pennsylvania

Hal White <halwhite@udel.edu>

Late June marks the peak of Odonata diversity in central Pennsylvania and an ideal time and place for the annual meeting of the Dragonfly Society of the Americas. The 84 species reported, the most for any annual DSA meeting, attests to that. However, that number obscures the challenges posed by the weather in State College, home of Accuweather. Their accurate predictions of clouds, cool days, and some rain on most days were ignored by many who still enjoyed the camaraderie of colleagues in the field while exploring interesting habitats. Fortunately, there were a couple of nice days. The day-long rain of almost two inches coincided with Saturday's indoor business meeting and presentations. Undoubtedly, that boosted attendance at the presentations by those anxious to be in the field.

In contrast to past meetings, there were no separate pre- and post-meeting trips. Rather, the many rich habitats within an hour of State College provided a single base of operations that allowed participants flexibility in their arrival and departure plans and the opportunity to have different groups visit particular sites on different days, thus minimizing damage to sensitive habitats.

Betsy Leppo, biologist for the Western Pennsylvania Conservancy, chaired an organizing committee composed of Dan Bogar, Ben Coulter, Ken Lebo, Tony Schoch, Mike Slater, Hal White, and Peter Woods. Plans included a float trip down a section of the Juniata River, a picnic at Whipple's Dam State Park, an OdeBlitz at Black Moshannon

Spatterdock Darner (*Rhionaeschna mutata*), Ten Acre Pond, Scotia, Pennsylvania. Photo by Ken Lebo.

State Park, and an exploration of remote sections of Penn's Creek and Poe Valley. Ten Acre Pond, Bear Meadows, and Beaver Dam meadow, within 15 miles of State College, provided local sites for exploration on multiple days. Mike Moore created the very informative meeting website. Jerrell Daigle and Bryan Pfeiffer organized the formal program, although Bryan was unable to attend the meetings.

Tuesday 23 June was a travel day to the meetings, the last day of the month to exceed 80°F and only one of four days in that week to exceed 70°F. That day also featured some aggressive afternoon thunderstorms. In between down-

pours, Jim White and I, travelling from Delaware, managed to explore a previously unsurveyed bog at the southern boundary of Centre County between State College and Lewistown. It proved interesting with robust populations of *Cordulia shurtleffii* (American Emerald), *Leucorrhinia hudsonica* (Hudsonian Whiteface), *Lestes eurinus* (Amber-winged Spreadwing), *Enallagma hageni* (Hagen's Bluet), and *Nehalennia gracilis* (Sphagnum Sprite). It also was one of three sites where *Somatochlora walshii* (Brush-tipped Emerald) was found during the meetings.

Wednesday provided the best weather of the entire week and a number of sites were surveyed by several groups travelling independently. Ten Acre Pond did not disappoint, with 39 species encountered on that day or later in the week. Highlights there included *Rhionaeschna mutata* (Spatterdock Darner), whose image designed by Ed Lam graced the meeting t-shirts and whose face adorned the meeting button designed by Jerrell Daigle, as well as *Anax longipes* (Comet Darner), *Leucorrhinia glacialis* (Crimson-winged Whiteface), *Lestes dryas* (Emerald Spreadwing), and *Enallagma annexum* (Northern Bluet).

Beaver Dam meadow and associated Shaver Creek yielded 29 species including *Gomphus rogersi* (Sable Clubtail) in good numbers, *Lanthus parvulus* and *L. vernalis* (Northern and Southern Pygmy Clubtail), *Cordulegaster diastatops* (Delta-spotted Spiketail), *Helocordulia uhleri* (Uhler's Sundragon), *Somatochlora walshii*, and *Amphiagrion saucium* (Eastern Red Damsel). As with the 2005 northeast regional DSA meeting in State College, this habitat also provided excitement with two separate sightings of Timber Rattlesnakes, one of which rested quietly next to the entrance path and probably was passed unnoticed by many. Dan Duran saw the other crossing the road a few miles away. Further south, off Route 26, the shale mound at Martin's Gap and nearby Standing Stone Creek yielded *Hagenius*

Ovipositing Amber-winged Spreadwings (*Lestes eurinus*), Ten Acre Pond, Scotia, Pennsylvania. Photo by Mike Moore.

Sable Clubtail (*Gomphus rogersi*), Beaver Dam meadow, Pennsylvania. Photo by Bob Glotzhober.

brevistylus (Dragonhunter), *Ophiogomphus rupinsulensis* (Rusty Snaketail), and *Stylogomphus albistylus* (Eastern Least Clubtail).

Thursday dawned bright and sunny. Hoping the forecast of clouds and showers was wrong, 10 people participated in the scheduled float trip 8.5 miles down the Juniata River from the Lewistown Narrows to Port Royal. Relatively unexplored for odonates, the Juniata River excursion was intended to yield some large stream gomphids not previously known from the area. Unfortunately, the forecast was correct and the overcast that greeted our arrival produced occasional sprinkles and few dragonflies. Furthermore, the recent rains made the water turbid and swift, and raised water to levels that precluded wading. One cooperative *Ophiogomphus rupinsulensis* landed on a canoe thwart and a presumed but unconfirmed *Gomphus vastus* (Cobra Clubtail) may have been seen. Clay Corbin photographed the only *Hetaerina americana* (American Rubyspot) seen during the meetings. *Macromia illinoiensis* (Illinois River Cruiser) made several passes by the kayaks and canoes during the trip downstream. *Dromogomphus spinosus* (Black-shouldered Spinylegs) was also seen. The most dramatic event was a Bald Eagle swooping down on a young Wood Duck that managed to escape by diving under the water. On our return to State College, Jim White and I visited a fairly large fen near Licking Creek where Chris Beatty and associates had found a number of *Tachopteryx thoreyi* (Gray Petaltail) the previous day. They also found *Cordulegaster obliqua* (Arrowhead Spiketail) there.

Thursday evening, those arriving for the more formal meeting met old friends and new in the Ramada Inn's P. J. Harrigan's restaurant, where some lingered late. Plans were made for more structured trips to Ten Acre Pond, Beaver Dam meadow, and other sites not yet visited during the pre-meeting period.

Despite the misty overcast and cool air Friday morning, meeting participants fanned out and visited many sites. As the day progressed, the low overcast gradually burned off and the afternoon proved spectacular wherever people were. Dan Bogar led a group to the Raystown Branch of the Juniata River and reported the only *Argia apicalis* (Blue-fronted Dancer) and *A. translata* (Dusky Dancer) of the meeting. Several groups made it to Bear Meadows, a large sphagnum bog about 8 miles south of State College. The closing of various forest roads as part of the rattlesnake preservation area meant that maps were inaccurate and GPS directions were misleading. What should have been a 20 minute ride turned into an hour-long tour of Rothrock State Forest's labyrinth of forest roads. Among the highlights of the 19 species found at Bear Meadows were *Gomphaeschna furcillata* (Harlequin Darner), *Cordulia shurtleffiii* (American Emerald), *Somatochlora walshii*, *Leucorrhinia hudsonica*, and *Libellula quadrimaculata* (Four-spotted Skimmer). Steve Roble's exploration deeper into the bog yielded the only *Libellula axilena* (Bar-winged Skimmer) and *Sympetrum semicinctum* (Band-winged Meadowhawk) of the meetings.

Later in the day, as people converged on Whipple's Dam State Park for the meeting picnic, the lake at Whipple's Dam and Laurel Run upstream of the lake were explored extensively. Among the notable species found at the lake were *Gomphus lividus* (Ashy Clubtail), *Epitheca princeps* (Prince Baskettail), *Didymops transversa* (Stream Cruiser), *Enallagma divagans* (Turquoise Bluet), *E. traviatum* (Slender Bluet), and *E. vesperum* (Vesper Bluet). Upstream on Laurel Run at a spring run by the Sand Knob Shale Pit, *Cordulegaster erronea* (Tiger Spiketail) was found, and in the woods nearby several *Tachopteryx thoreyi* lurked. Much to the delight of onlookers Jim White and Kitt Heckscher, one left its tree trunk perch to chase a Great Spangled Fritillary for about 100 feet. It was like an ode Jurassic Park scene with the fritillary's desperate escape and the predator returning leisurely to his perch, from which he successfully caught a moth on another pursuit. Not far away, Betsy Leppo watched a female ovipositing in a boggy area by the spring run. Later, Melissa Sanchez and Will Kuhn working with Chris Beatty and Kristen Numata were able to find three *T. thoreyi* larvae there.

Cecil and Dave Leppo canoeing on the Juniata River. Photo by Jim White.

Gray Petaltail (*Tachopteryx thoreyi*) near Whipple Dam. Photo by Jim White.

The BBQ picnic catered by Doan's Bones was arranged by Jason Beale. The chicken, spare ribs, and pulled pork were delicious and there was plenty for all who had worked up big appetites. There was some excitement when the caterers arrived a bit late and in their haste dropped a whole tray of barbequed ribs on the floor of the pavilion. The brief clean-up delay didn't prevent a crowd of over 90 having a great time, (except perhaps treasurer Mike Blust, who had to collect picnic fees).

It poured outside during the business meeting at the Ramada Inn on Saturday. Clark Shiffer, one of the founding members of DSA and a State College resident who has extensively surveyed the Odonata of central Pennsylvania for over 40 years, was honored for his lifetime achievements. The group photo was taken indoors near the pool, surrounded by tropical plants. Although failing health prevented Clark from joining groups in the field during the meetings, he attended all of the presentations and was photographed with the group. Undoubtedly, it is because Clark has surveyed the area so thoroughly that not a single new county or site record was reported during the meeting.

That evening, about 15 people visited the Frost Entomological Museum on the Penn State University campus where

the large George and Alice Beatty Odonata collection is housed. Museum curator Andy Deans and his assistants hosted the visit and showed how the collection is being transferred to modern cabinets and individual specimens cataloged and digitized for future research. Ken Tennessen, Jerrell Daigle, Steve Roble, and Nick Donnelly spent time during the meetings studying specimens in the collection. After the visit the group walked across the street in the rain to the Penn State Creamery for a taste of its legendary ice cream, one of which is called "Peachy Paterno".

The OdeBlitz scheduled for Sunday at Black Moshannon State Park fizzled with sweater weather, clouds, and occasional showers. Many participants headed home; a few hardy souls ventured out to look at orchids and birds. Among only five Odonata species found at Black Moshannon that day was a female *Somatochlora forcipata* (Forcipate Emerald) caught by Josh Rose! Jim Johnson and Steve Valley did a little exploring at Sawyer's Dam on their way back from Black Moshannon. There they found the only *Enallagma basidens* (Double-striped Bluet) reported for the meetings. They also encountered *E. traviatum*, which is uncommon in central Pennsylvania.

Monday was a cool but comfortable sunny day. The remaining group headed back to Black Moshannon State Park to continue the "OdeBlitz" of the area. Jim White photographed a male *Somatochlora forcipata* and Mike Moore got his lifer photo of a female. He also got a photo of *Enallagma divagans* for the first record of the species in the park in over 50 years. Betsy Leppo found *Gomphus borealis* (Beaverpond Clubtail) at an abandoned beaver pond on Corbin Run and found an early *Aeshna canadensis* (Canada Darner). Black Moshannon State Park also produced the only *Gomphus spicatus* (Dusky Clubtail) for the meetings. Robin Pranter from Sweden caught a *Cordulegaster obliqua*. On Six Mile Run in Black Moshannon State Forest earlier in the week, a group with Steve Valley, Jim Johnson, Cary Kerst, and Marla Garrison found *Calopteryx amata* (Superb Jewelwing) and had an unconfirmed sighting of *Cordulegaster maculata* (Twin-spotted Spiketail). Marla found the larvae of *C. maculata* there and in several other streams during the meetings. This gorgeous roaring stream flowed crystal clear despite the high water from recent rains. It looked like a perfect *Ophiogomphus* (Snaketail) stream, but was too dangerous to wade and there were no exposed rocks for perching dragonflies. A total of 32 species was found in the park during the meetings.

With clouds returning Tuesday morning, any hope of a quick survey of the Penn's Creek area disappeared. Overall the meetings confirmed the impressive odonate diversity of central Pennsylvania. Despite a list of 84 species, several that would normally be expected, such as *Libellula incesta* (Slaty Skimmer), *Perithemis tenera* (Eastern Amberwing), *Pantala flavescens* and *P. hymenaea* (Wandering and Spot-winged Glider), and *Ischnura hastata* (Citrine Forktail) were not seen. A list of all species seen during the meeting follows.

Complete species list from DSA Annual Meeting

Calopteryx amata (Superb Jewelwing)
C. maculata (Ebony Jewelwing)
Hetaerina americana (American Rubyspot)
Lestes congener (Spotted Spreadwing)
L. dryas (Emerald Spreadwing)
L. eurinus (Amber-winged Spreadwing)
L. forcipatus (Sweetflag Spreadwing)
L. inaequalis (Elegant Spreadwing)
L. rectangularis (Slender Spreadwing)
L. vigilax (Swamp Spreadwing)
Amphiagrion saucium (Eastern Red Damsel)
Argia apicalis (Blue-fronted Dancer)
A. fumipennis violacea (Violet Dancer)
A. moesta (Powdered Dancer)
A. translata (Dusky Dancer)

Forcipate Emerald (*Somatochlora forcipata*), Black Moshannon, Pennsylvania. Photo by Jim White.

Robin Prather stalking the wild Painted Skimmer (*Libellula semifasciata*) at beaver pond on Corbin Run, Black Moshannon. Photo by Jim White.

Chromagrion conditum (Aurora Damsel)
Enallagma annexum (Northern Bluet)
E. aspersum (Azure Bluet)
E. basidens (Double-striped Bluet)
E. civile (Familiar Bluet)
E. divagans (Turquoise 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 gracilis (Sphagnum Sprite)
N. irene (Sedge Sprite)
Tachopteryx thoreyi (Gray Petaltail)
Rhionaeschna mutata (Spatterdock Darner)
Aeshna canadensis (Canada Darner)
Anax junius (Common Green Darner)
A. longipes (Comet Darner)
Epiaeschna heros (Swamp Darner)
Gomphaeschna furcillata (Harlequin Darner)
Arigomphus villosipes (Unicorn Clubtail)
Dromogomphus spinosus (Black-shouldered Spinyleg)
Gomphus borealis (Beaverpond Clubtail)
G. exilis (Lancet Clubtail)
G. lividus (Ashy Clubtail)
G. rogersi (Sable Clubtail)
G. spicatus (Dusky Clubtail)
Hagenius brevistylus (Dragonhunter)
Lanthus parvulus (Northern Pygmy Clubtail)
L. vernalis (Southern Pygmy Clubtail)
Ophiogomphus rupinsulensis (Rusty Snaketail)
Stylogomphus albistylus (Eastern Least Clubtail)
Cordulegaster diastatops (Delta-spotted Spiketail)
C. erronea (Tiger Spiketail)
C. obliqua (Arrowhead Spiketail)
Didymops transversa (Stream Cruiser)
Macromia illinoiensis illinoiensis (Illinois River Cruiser)
Cordulia shurtleffii (American Emerald)
Dorocordulia libera (Racket-tailed Emerald)
Epitheca cynosura (Common Baskettail)
E. princeps (Prince Baskettail)
Helocordulia uhleri (Uhler's Sundragon)
Somatochlora forcipata (Forcipate Emerald)
S. walshii (Brush-tipped Emerald)
Celithemis elisa (Calico Pennant)
C. eponina (Halloween Pennant)
Erythemis simplicicollis (Eastern Pondhawk)
Ladona julia (Chalk-fronted Corporal)
Leucorrhinia frigida (Frosted Whiteface)
L. glacialis (Crimson-ringed Whiteface)
L. hudsonica (Hudsonian Whiteface)
Leucorrhinia intacta (Dot-tailed Whiteface)
Libellula axilena (Bar-winged Skimmer)
L. cyanea (Spangled Skimmer)
L. luctuosa (Widow Skimmer)
L. pulchella (Twelve-spotted Skimmer)
L. quadrimaculata (Four-spotted Skimmer)
L. semifasciata (Painted Skimmer)
Pachydiplax longipennis (Blue Dasher)
Plathemis lydia (Common Whitetail)
Sympetrum internum (Cherry-faced Meadowhawk)
S. rubicundulum (Ruby Meadowhawk)
S. semicinctum (Band-winged Meadowhawk)
S. vicinum (Autumn Meadowhawk)
Tramea carolina (Carolina Saddlebags)
T. lacerata (Black Saddlebags)

The 2015 DSA Annual Meeting participants. Photo by Steve Valley.

Abstracts From the 2015 DSA Annual Meeting in Central Pennsylvania

***George H. and Alice Ferguson Beatty and Their Odonata Collection at Penn State*, Hal White and Andrew R. Deans.** George H. Beatty, III (1923–2004) and Alice Ferguson Beatty (1915–1987) lived in the State College, Pennsylvania area from their marriage in 1956 until their respective deaths. An interest in Odonata brought them together. They were the first to extensively survey the local Odonata fauna and bring together published and unpublished information of Pennsylvania Odonata; the results of these efforts appear in a series of publications between 1968 and 1971. They also had an interest in the Odonata of Mexico, and made seven expeditions there between 1957 and 1970. Virtually all of their Mexican work is unpublished. Their large Odonata collection of over 50,000 specimens is now located in the Frost Entomological Museum at the Pennsylvania State University, where it is actively being digitized and remains available for research.

***Inferring Species Residency in Standardized Adult Dragonfly Surveys*, Jason Bried, Amanda Dillon, Barbara Hager, Michael Patten, Barney Luttbeg.** For dragonflies, final exuviae provide the most identifiable larval stage, can substitute for lethal processing of live animals, and definitively indicate life-cycle completion or reproductive success. However, dragonfly exuviae are difficult to find and identify relative to adults in certain species, and species richness in exuviae surveys is generally biased low. We tested readily acquired information in adult surveys as indicators of exuviae presence and, therefore, species residency. Repeated concurrent surveys of adults and exuviae were completed at 32 wetlands in New York and 30 wetlands in Oklahoma, USA. We modeled the occurrence of exuviae as logit-linear functions of adult abundance, detection frequency (across surveys), teneral frequency, and frequency of breeding behavior while controlling for imperfect detectability. Exuviae occupancy probabilities suggested several reliable indicators of species residency: 1) finding adults on ≥4 surveys, 2) finding tenerals on ≥2 surveys, and 3) counting >20 adults on ≥1 surveys (with caveats). The odds of exuviae occurrence when these conditions were met were ~9 to 18 times greater than when no adults were detected. Species residency may be accurately inferred during adult surveys, potentially improving freshwater applications and conservation via dragonflies.

***A Photographic Review of the Dragonfly Orthemis schmidti*, Jerrell J. Daigle.** Photographic identification of *Orthemis schmidti* Buchholz 1950 is reviewed along with comments on its history, taxonomy, ecology and distribution of this New World species. The holotype female is on loan from Japan to the Florida State Collection of Arthropods, and many photos of it are posted on OdonataCentral. The non-pruinose male with its scarlet abdomen is officially undescribed. This widespread species occurs from southern Brazil to western Mexico, east to the British Virgin Islands and Florida with a recent vagrant photographed in Oklahoma. High-resolution scanning electron microscopy photos are used along with web-based and colleague-contributed photos from field observers.

***Counting the Spots: A Molecular Phylogeny of the Spotted Darner Boyeria (Anisoptera: Aeshnidae) with an Emphasis on European Taxa*, Manpreet Kohli.** *Boyeria irene* and *B. cretensis* are species of spotted dragonflies belonging to the darner family, Aeshnidae. In 1991, *Boyeria* from the Island of Crete was classified as *B. cretensis sp. nov.*, based on adult morphological characters. In this study, we used molecular evidence to determine if indeed *B. irene* and *B. cretensis* are different species. DNA was sequenced from samples of *B. irene* (from France, Switzerland, Tunisia, Spain and Italy) and *B. cretensis* (from Crete). These species were recovered as two different clades with strong support. We support the claim that *B. irene* and *B. cretensis* are different species, with evidence based on molecular and morphological differences. In addition, we present the first phylogenetic hypothesis for the genus *Boyeria*, for which we have sequenced all but three species. Lastly, we discuss timing of the split and different scenarios that may have led to the present day distribution patterns of *B. irene* and *B. cretensis*.

***The Story of "Many Thunders": An Overview of the Genus Polythore*, Melissa Sanchez Herrera.** The Neotropics holds the highest species richness of Odonata; however, this region is still understudied. Despite an increase in biodiversity surveys and new species descriptions for odonates, few studies examine the genetic and morphological diversity within taxa. Neotropical damselflies in the genus *Polythore* are stunningly colorful; their wings display orange, black, and/or white. Despite this color diversity, they lack variation in classical reproductive traits (e.g. male genitalia) commonly used for species description. The genus comprises 21 described morphospecies distributed along the Eastern slopes of the Andes cordillera and the Amazon basin, through Colombia to Northern Bolivia. They dwell in small, fast-flowing creeks with highly oxygenated waters; their nymphs are the only Mesoamerican damselflies that possess abdominal gills and highly modified structures at their posterior end for stability in fast flowing waterfalls. Here I present an overview of the evolutionary history, species diversity and morphological diversity of *Polythore*. I discuss the novel morphological methods (geometric morphometrics, chromaticity analysis, and Gabor wavelet transformation) that help analyze the complexity of the wing color pattern present in this genus. Phylogenetic reconstruction

and species delimitation using mitochondrial (COI, ND1) and nuclear (H3, PMRT, MLC) gene fragments show a lack of congruence between wing color morphs, supporting the presence of possible cryptic and/or polytypic species.

***Identifying the World's Dragonflies and Damselflies Ode-O-matically!*, Will Kuhn, Jessica Ware, Gareth Russell.** In North America, we enjoy an abundance of resources for identifying Odonata fauna: an invaluable repository for odonate information at OdonataCentral, myriad regional field guides, and many local experts. In order to make accurate species identifications—vital for biodiversity assessments and conservation efforts—in many other less-studied countries, workers must delve through original species descriptions, lists, and revisions, if available. We aim to solve this problem, at least in part, by building an automatic identification system for Odonata: an online tool whereby anyone can get rapid, accurate odonate identifications. Here, we present a prototype of this software, which first extracts useful descriptive features from image examples of known species and then uses that information to train a classification algorithm. This algorithm can then be applied to images of unknown specimens, producing a list of the top-matching species. Our system has shown up to 93% accuracy when tested on scans of wings from adults of 12 common odonate species; however, we plan to test it on a much larger, more disparate dataset. A planned online implementation of this software would be self-updating, retraining itself periodically (thus getting "smarter") with newly available images; it could incorporate geographic and temporal range data to increase its accuracy, and could be configured to have oversight from an OdonataCentral-style community of experts. Like the rise of OdonataCentral in recent years, we hope our tool will become an invaluable resource for the worldwide odonate community.

***The Petaltail Dragonflies (Odonata: Petaluridae): Mesozoic Habitat Specialists that Survive to the Modern Day*, Christopher D. Beatty, Jessica L. Ware, Melissa Herrera Sánchez, Steve Valley, Jim Johnson, Cary Kerst, Michael L. May, Gunther Theischinger.** Dragonflies are an ancient group of organisms, appearing in the fossil record for the last 325 million years; however, individual dragonfly species, like other arthropod species, are thought to persist only for ~10 million years. Here we'll present results suggesting that the species of one family, Petaluridae, are much older. The 11 extant species in the family are found in Australia, New Zealand, Chile, Japan and North America. Results of our molecular phylogenetic and BEAST molecular clock analyses suggest that the petaltails originated ~160 million years ago, and that many have persisted as independent lineages for ~70 million years. Simulations of past distributions suggest that the petaltails first expanded along the coast of the supercontinent Pangaea, arriving at their current locations through continental drift. These long species 'lifespans' are surprising, especially for a group of habitat specialists (petaltail nymphs live exclusively in seep and fen habitats) with multi-year development times. We will discuss how these attributes might contribute to the unique persistence of this family.

***The Biogeography of the Gray Petaltail, Tachopteryx thoreyi: A Preliminary Exploration*, Kristen Numata, Christopher Beatty, John Abbott, David McMillan, Kathleen Harding, Jessica Ware.** The dragonfly family Petaluridae is a relict group that first radiated along the coast of Pangaea approximately 160 million years ago (Ma). Eleven extant species are found in Australia, New Zealand, Chile, Japan and North America, mostly along coastlines. One species—the Gray Petaltail (*Tachopteryx thoreyi*), in eastern North America—has a broad distribution relative to the other species, with populations found in habitats ranging from central New York state west to Oklahoma and Texas, and as far south as Florida. This species separated from its nearest relative approximately 100 Ma, a time associated with the formation of the Western Interior Seaway (WIS), which covered much of the center of North America from 110–70 Ma. Through population genetic analysis I am exploring the hypothesis that the WIS influenced the current distribution of *T. thoreyi* through isolation of this species from its closest living confamilial. I extracted DNA from a hypervariable region of the nuclear 28S (D2) sequence from adult specimens of *T. thoreyi* from throughout its range, collected from field and museum specimens. I will present preliminary analyses of these data, looking for patterns in haplotype distributions that indicate the historical biogeography of this species.

***Using the lateral plate of the ovipositor to distinguish female Aeshna interrupta from similar species*, Jim Johnson.** Females of a number of North American species of *Aeshna* and *Rhionaeschna* can be challenging to identify due to superficial similarity and variation. While often useful, coloration and pattern are subject to geographical, age-related, and individual variation, which result in misdiagnosed individuals when structural characters are not examined critically. In western North America the females of two species are especially problematic: *A. palmata* and the highly variable *A. interrupta*. In diagnosing these species based on structural characters, identification resources typically rely on the presence (*A. interrupta*) or absence (*A. palmata*) of a minute tuft of setae at the terminal angle of the ovipositor valves. But even this is subject to variation in both species, with some *A. interrupta* lacking (or nearly so) setae at the terminal angle, and some *A. palmata* possessing setae that appear to form a small tuft. The shape of the ovipositor valves is also mentioned as a distinguishing character by some resources, but this can be difficult to assess consis-

tently, and may be affected by the position of the gonapophyses and perhaps also by post-mortem effects. Female *R. multicolor* can also be confused with female *A. interrupta* when the ventral tubercle on S1 is not well developed. I discovered another structural character that appears to be unique to female *A. interrupta* among the North American *Aeshna* and *Rhionaeschna*: the lateral plate of the ovipositor is more acutely angular, with the straight sides forming a 90° angle or less; the lateral plate on females of other species is obtusely angular or broadly rounded with the straight sides forming an angle of 120° or more. This character is more easily assessed on a consistent basis than the characters previously mentioned and exhibits less variation.

***Ophiogomphus fastigiatus: A New Status Based on Material Collected by Clark Shiffer*, T. W. Donnelly.** When the original specimen of *Ophiogomphus fastigiatus* was collected in Nicholas County, West Virginia in 1969, it seemed a clear species. I did not find it later until I visited Sullivan County with Clark Shiffer in 1983, when we collected numerous males and females on Loyalsock Creek near LaPorte. Two specimens from Delaware Co., N.Y., were clearly intermediate with *O. mainensis*, falling half way between this new species and *O. mainensis* from the Beaverkill River and nearby localities in the New York Catskills. These intermediates were the reason that fastigiatus was named as a subspecies in 1987 (additional "intermediates" from central Pennsylvania are now considered minor variants of *fastigiatus*). When I was curating the Shiffer collection for deposition in the Florida State Collection of Arthropods, I found a specimen from Beaverdam, Huntingdon Co. (a field trip venue for this meeting), that Clark had collected in 1988, of pure *O. mainensis*. This specimen is the dominant, but not only, evidence that fastigiatus should be considered a species. During the period subsequent to the 1987 description of *fastigiatus*, Ken Soltesz reared and collected adults of pure *O. mainensis* from several localities on the Delaware during an Odonata survey of this river. The body of evidence is now that *fastigiatus* should be considered an *Ophiogomphus* species in its own right, closest to *O. mainensis*, with which it has an almost perfectly complete allopatric relationship. The two Beaverkill specimens should be considered as hybrids, in a genus of which hybrids have been found several times. *O. fastigiatus* remains a severely undercollected species.

***Citizen Science Web Initiatives for Odonata*, John C. Abbott.** The odonate community is a leader in the realm of citizen science with the long, successful history of OdonataCentral <www.OdonataCentral.org>. Through a multi-national effort, more recently, two additional citizen science web initiatives have been launched to help us understand dragonfly migration. I will provide an update and overview of these endeavors including how the data is being used and plans for the future.

***Copulation-associated Color Change in Argia apicalis (Odonata: Coenagrionidae)*, Amanda Whispell.** In the Odonata, the gradual development of adult coloration during the post-eclosion teneral period is a well-known phenomenon, and these morphological color changes occur slowly and irreversibly. Physiological color change, on the other hand, is always rapid and reversible, and has been studied in only a few insect species. A diverse set of theories has been put forth in an effort to explain the mechanism controlling the color change, as well as the adaptive benefit that it offers. While the change exhibited by most species is primarily temperature-sensitive—changing to dark-phase coloration when below a certain temperature threshold, and then returning to a bright-phase when the temperature rises above it—this is not always the case. Although not yet documented, it has been witnessed on several occasions that male *Argia apicalis* also change color, from bright-phase to dark-phase, during copulation. Given past research into the selective advantage of physiological color change, the ability to change color in direct response to copulation could offer multiple rewards. The capacity to thermoregulate while in copula may well be beneficial, as would cryptic coloration in regards to predator avoidance. Since colors are often so important in intraspecific communication, it could be to *A. apicalis*' advantage to advertise readiness to mate while in bright-phase, and then to become less conspicuous during copula by transforming into dark-phase. I am currently in the process of working to document the phenomenon's existence, and future work will be geared towards determining the mechanism that drives it.

From *Acanthagrion* to *Zenithoptera*: The DSA Trip to Costa Rica, Cary Kerst and Bryan Pfeiffer.

Don't Forget to Pay Your DSA Dues for 2016!

Aloha, everyone! Thank you to everyone who sent their 2015 DSA dues. If you have questions about when your membership expires, or how to pay your 2016 dues or access your account and profile, please contact me at <jdaigle@nettally.com>. Thank you very much—aloha nui!

Jerrell Daigle, DSA Treasurer

Yet Another Successful Southeastern DSA Meeting

Steve and Mary Jane Krotzer <rskrotze@gmail.com>

Following a very successful 2012 meeting in central Tennessee, we decided to convene the 2015 southeastern DSA meeting in Tennessee again, but this time in the extreme northeastern corner of the state in Erwin, a little town in Unicoi County at the base of the Blue Ridge Mountains. Having a dragonfly meeting in the middle of the summer in the South is always a chancy proposition—it's hot, it's humid, there are usually afternoon thunderstorms rumbling around, and to be honest it's not the peak dragonfly season around here! But…the prospect of seeing some regional rarities such as *Somatochlora elongata* (Ski-tipped Emerald), *Cordulegaster erronea* (Tiger Spiketail), *Lestes eurinus* (Amber-winged Spreadwing), and *Enallagma hageni* (Hagen's Bluet) was just too enticing to pass up. So, on 23 July 2015 we loaded up the SUV and headed up (in the rain!) toward the Tennessee/North Carolina border. When we arrived (in the rain!) we discovered that several folks had already been there for a day or longer, and they had not been seeing much. We were not deterred, though; the weather forecast for the weekend was favorable, and we had a secret weapon. Richard Connors, Larry Everett, and Don Holt, three outstanding biologists who had spent a lot of time in the area, and knew all the "hot spots", were not going to let us down!!

Participants arrived from all over the country, from the west (Washington and Oregon), north (New Jersey), and south (Florida). We had the usual mix of seasoned veterans like Dennis Paulson, Jerrell Daigle, and Bill Mauffray, as well as some relative newcomers. Heck, we even had a monk! How could we not have a good meeting!?!

Jerrell Daigle, Cary Kerst, and Bill Mauffray (L to R) looking at *Stylogomphus albistylus* (Eastern Least Clubtail), Hampton Creek Cove SNA, 23 July 2015. Photo by Tony "Doc" Schoch.

Ski-tipped Emerald (*Somatochlora elongata*), Marlene Mountains ponds, Erwin, Tennessee. Photo by Buck Snelson.

We gathered in the usual disarray in the parking lot of the Mountain Inn & Suites on Friday morning, eventually divided into two groups, and headed out into the field. Although it was cloudy and spitting rain when we left, the weather improved throughout the day and there were some bugs to be seen. One group visited a series of "bogs" (more like wet meadows with ditches) and ponds and saw a good number of odonates, although most were common species. However, Amber-winged Spreadwing (*Lestes eurinus*) was added to this thoroughly-studied area as a new record for Johnson County, which was a nice surprise. The other group visited a couple of mountain ponds known to have *S. elongata*, and also went to some seepage streams looking for *C. erronea*; these efforts were minimally successful, as both species were seen but in very low numbers.

Saturday was a gorgeous, sunny day; after the group photo in the parking lot, everyone dispersed to look for species they had missed seeing the previous day. Folks who went looking for *S. elongata* and *C. erronea* had better luck today; numerous Tiger Spiketails were seen and photographed at Hampton Cove SNA, and several Ski-tipped Emeralds entertained the group that went to "Marlene's Ponds". Marlene Wills was gracious enough to allow our "herd" to tramp around her beautiful property where we also saw *Tachopteryx thoreyi* (Gray Petaltail), to the delight of several photographers. That evening, to celebrate our

successful day in the field, most of the group continued the SE DSA tradition of dinner at a local Mexican restaurant (Los Jalapenos—rumor has it that the margaritas were weak but the draft beer was excellent!!).

Sunday was another beautiful day; a large group went back up to the Shady Valley bogs and added a few more species to the trip list. The other group went to Rocky Fork State Park in the morning and was treated to multiple sightings of both *S. elongata* and *C. erronea*. As a reward, this group took the afternoon off to chase butterflies, most notably Diana Fritillary and American Copper. After a nice dinner at a local Italian joint, there was time for a bit of reminiscing back in the hotel lobby.

Monday morning dawned cloudy and humid; with rain in the forecast, it seemed a fitting time to say our good-byes and head back home. We were ecstatic with the way the meeting had gone; despite a slow start, a total of 60 species (listed below) were seen, photographed, or collected during the three "official" meeting days, and I suspect there were several additional species seen by folks en route to or from the meeting. I'm pretty sure that everyone who really wanted to see the two main target species was able to do so, and all of the target species were seen! The sites along the Nolichucky River were not as productive as might have been expected, but that's just the way it goes sometimes during the heat of the summer. Larry Everett was able to pull some interesting nymphs out of the Nolichucky and a couple of smaller streams; those records are included in the list below.

All in all, it was a very productive meeting; the weather was great and everybody seemed to enjoy their time in east Tennessee. Special, special thanks to Richard, Larry, and Don; they really were the key to finding the "good bugs" during the meeting.

"DSA Treasurer among Nature's treasures". Jerrell Daigle lurks in *Echinacea*, Roan Mountain, Tennessee. Photo by Cary Kerst.

Species list from 2015 SEDSA Meeting. Species names followed by N indicate that only nymphs were found.

ZYGOPTERA (DAMSELFLIES)

Family Calopterygidae (Broad-winged Damsels)
Calopteryx maculata (Ebony Jewelwing)
Hetaerina americana (American Rubyspot)

Family Lestidae (Spreadwings)
Archilestes grandis (Great Spreadwing)
Lestes australis (Southern Spreadwing)
L. eurinus (Amber-winged Spreadwing)
L. rectangularis (Slender Spreadwing)

Family Coenagrionidae (Pond Damsels)
Argia apicalis (Blue-fronted Dancer)
A. fumipennis (Variable Dancer)
A. moesta (Powdered Dancer)
A. sedula (Blue-ringed Dancer)
A. tibialis (Blue-tipped Dancer)
A. translata (Dusky Dancer)
Enallagma aspersum (Azure Bluet)
E. basidens (Double-striped Bluet)
E. daeckii (Attenuated Bluet)
E. exsulans (Stream Bluet)
E. geminatum (Skimming Bluet)
E. hageni (Hagen's Bluet)
E. signatum (Orange Bluet)
E. traviatum (Slender Bluet)
Ischnura hastata (Citrine Forktail)
I. posita (Fragile Forktail)
I. verticalis (Eastern Forktail)

ANISOPTERA (DRAGONFLIES)

Family Petaluridae (Petaltails)
Tachopteryx thoreyi (Gray Petaltail)

Family Aeshnidae (Darners)
Aeshna umbrosa (Shadow Darner)
Anax junius (Common Green Darner)
Boyeria vinosa (Fawn Darner)
Epiaeschna heros (Swamp Darner)

Family Gomphidae (Clubtails)
Dromogomphus spinosus (Black-shouldered Spinyleg)
Erpetogomphus designatus (Eastern Ringtail)
Gomphus adelphus (Mustached Clubtail), N
G. lividus (Ashy Clubtail), N
G. rogersi (Sable Clubtail), N

Hagenius brevistylus (Dragonhunter)
Lanthus vernalis (Southern Pygmy Clubtail), N
Stylogomphus albistylus (Eastern Least Clubtail)
Stylurus laurae (Laura's Clubtail), N
S. spiniceps (Arrow Clubtail), N

Family Cordulegastridae (Spiketails)
Cordulegaster erronea (Tiger Spiketail)

Family Macromiidae (Cruisers)
Macromia illinoiensis (Illinois River Cruiser)

Family Corduliidae (Emeralds)
Epitheca princeps (Prince Baskettail)
Somatochlora elongata (Ski-tipped Emerald)

Family Libellulidae (Skimmers)
Celithemis elisa (Calico Pennant)
C. fasciata (Banded Pennant)
Erythemis simplicicollis (Eastern Pondhawk)
Libellula axilena (Bar-winged Skimmer)
L. cyanea (Spangled Skimmer)
L. incesta (Slaty Skimmer)
L. luctuosa (Widow Skimmer)
L. pulchella (Twelve-spotted Skimmer)
L. semifasciata (Painted Skimmer)
Pachydiplax longipennis (Blue Dasher)
Pantala flavescens (Wandering Glider)
Perithemis tenera (Eastern Amberwing)
Plathemis lydia (Common Whitetail)
Sympetrum rubicundulum (Ruby Meadowhawk)
S. semicinctum (Band-winged Meadowhawk)
S. vicinum (Autumn Meadowhawk)
Tramea carolina (Carolina Saddlebags)
T. lacerata (Black Saddlebags)

Dennis Paulson viewing Gray Petaltail (*Tachopteryx thoreyi*), Marlene Mountains ponds, Erwin, Tennessee. Photo by Buck Snelson.

The SE DSA Annual Meeting crew.

Odonate Symposium at the International Congress of Entomology, 25–30 September 2016

Sebastian Büsse, Kiel University <sbuesse@zoologie.uni-kiel.de>

Dear Odonate community,

We are pleased to announce that we will be hosting an odonate symposium at the International Congress of Entomology, which is being held 25–30 September 2016 in Orlando, Florida, USA.

The International Congress of Entomology (ICE2016) is the biggest congress of its kind, and will be attended by around 3000 participants from all around the world. The congress will feature a large number of symposia ranging from applied ecology, to physiology, morphology and genomics across all insect taxa.

We (Maren Wellenreuther, Seth Bybee, and Sebastian Büsse) will hold an odonate specific symposium to showcase the amazing research that can be done with this group. We would like to take this opportunity to kindly invite you all to our symposium: "Next generation ecology, morphology and genomics: what can we learn about the evolution of Odonata?" at the ICE2016. This meeting will provide a fantastic opportunity to highlight the unique characteristics and fascinating ecology of odonates to the wider insect community. We are very much excited about this opportunity, and hope that some of you may attend the conference.

If you have any queries, please feel free to contact us at <sbuesse@zoologie.uni-kiel.de>. All our best, Maren, Seth & Sebastian.

Macromia taeniolata—New State Record for Minnesota (Otherwise Known as "The Great Royal River Cruiser Chase")

Dan Jackson, Chaseburg, Wisconsin <DanJackson@lbwhite.com> and **William Smith,** Middleton, Wisconsin

Bill Smith first discovered the Royal River Cruiser (*Macromia taeniolata*) on the upper Mississippi River in extreme southwestern Wisconsin and northeast Iowa in 1988. He also found one on the Wisconsin River several miles upstream from the point where it joins the Mississippi later that same year (Bob DuBois confirmed this location with a sighting in 2011).

In July of 2011, he and Bob spent two days on the Mississippi River below La Crosse, Wisconsin in hopes of extending the northern known range of the species on the Mississippi River. This search was funded in part by the US Fish and Wildlife Service's State Wildlife Grant Program as a part of a status survey conducted by the Wisconsin DNR Natural Heritage Inventory Program for Species of Greatest Conservation Need. During that survey, they did find a few *M. taeniolata* at a new location on Iowa side of the river, but did not significantly extend the known range on the Mississippi River.

On 20 August 2011, while on a family vacation at Wyalusing State Park in the northwest corner of Grant County, I noticed a large, dark dragonfly cruising up and down the campground road. I was able to catch it and verify that it was a Royal River Cruiser. The next day, I discovered that it was not a fluke, as I found many of them in several locations from Wyalusing State Park down to the original sighting location below Cassville, Wisconsin. This was a late sighting compared to earlier Wisconsin records and made us realize that this species flies longer than previously understood in this area.

Almost two weeks later, on 1 September 2011, while birding on the Mississippi River near Stoddard, Wisconsin

Voucher specimen for 1st Royal River Cruiser (*Macromia taeniolata*) for the state of Minnesota Photo by Dan Jackson.

(about 50 miles north of Wyalusing State Park), I spotted what I thought was another Royal River Cruiser. When I reported that sighting to Bill and Bob, they decided that another trip to the area was in order. Since Bob was not available, Bill enlisted Ken Tennessen to join him on 7–8 September 2011. They checked out a couple of locations on 7 September and had another tantalizing possible sighting on the Minnesota side of the river close to where I thought I might have seen one the week before.

On 8 September, Abi Saeed, Jeremy Jackson and I joined Bill and Ken and we headed even farther north. We spent a few hours on Pool 7 of the Mississippi starting just below the Trempealeau Dam at Trempealeau, Wisconsin. We did not see any *M. taeniolata*, but did find a strong flight of *Stylurus notatus* (Elusive Clubtail)and *S. plagiatus* (Russet-tipped Clubtail). When we headed back to the landing, a fisherman asked Bill what we were up to. Bill described the Royal River Cruiser to him and the gentleman indicated that he had never seen them in the Trempealeau area but had seen them below the Genoa Dam a few miles south of Stoddard (just south of where Bill and Ken had been surveying the day before). After a short discussion, the boats were loaded up and we were headed south toward the landing below the Genoa Dam!!

Abi, Jeremy, and I had just pushed off from the landing when a big, dark dragonfly with bright green eyes zoomed between Jeremy and me and then rocketed skyward. We spent a few more hours searching that area and Ken and Bill had one more probable sighting about a mile to the south. Once again, we had probable sightings but didn't have a voucher for proof.

A few days later, on 12 September, I stopped at the Genoa Dam boat landing for another shot. While watching from shore, I spotted what looked like a *M. taeniolata* fly by. I adjusted my location and waited in hopes that it would return. Within five minutes, I spotted a big, low-flying, dark dragonfly flying down the shoreline toward the spot where I was standing. The brilliant green eyes soon became obvious and luckily I was able to catch it. It turned out to be a female and the new northern-most record of *M. taeniolata* for the state of Wisconsin. From where it was caught, the Minnesota state line was only 200 yards away. It was now obvious that this species had to be flying in Minnesota!

In late June of 2012, I once again found many *M. taeniolata* flying over sloughs of the Mississippi River in the waters adjacent to Wyalusing State Park. That was my signal that it was time to try to find the first-ever for Minnesota. On 8 July 2012, my wife Joanne and our two dogs joined me for a boat trip as I headed across the main channel

Female Royal River Cruiser (*Macromia taeniolata*), Vernon County, Wisconsin. Photo by Dan Jackson.

from the spot where I had caught the female the previous fall. Based on the flight pattern that I had noticed at Wyalusing the week before, I headed into the first small slough that I came to on the Minnesota side of the river. It turned out that I didn't have long to wait. I had only proceeded about 100 yards up the slough when I started to see patrolling male Royal River Cruisers flying along the shoreline of the slough. We pulled in to shore and within a few minutes I was excited to catch a new Minnesota state record dragonfly!

Two weeks later, I was able to catch another voucher farther north in La Crosse County, Wisconsin and I also had a sight record in Winona County, Minnesota. Over the last two years, I have been able to extend the northern limit of this population into Pool 7 about 15 miles north of La Crosse, Wisconsin. I haven't been able to catch a voucher for Winona County, Minnesota but have seen them in that county on two occasions. This summer, I hope to further extend the known range of this species on the Mississippi River into one or two more counties in Wisconsin and Minnesota.

On 13 July 2013, Bill Smith and Denny Johnson made the first confirmation of breeding of the species on the Upper Mississippi River. They found two exuviae at the site where Bill had originally found the species in Wisconsin 25 years earlier near a closing dam between Glen Haven and Cassville. The exuviae were almost out of reach on trees adjacent to the slough.

At this point, it is hard to say if these new records represent a range expansion for this species or are simply the result of more survey effort on the Mississippi. I would encourage others to check out the sloughs on the river near Wabasha and Winona. It will be interesting to see just how far the range of *M. taeniolata* extends up the Mighty Mississippi!

Thornbush Dasher (*Micrathyria hagenii*), a New Record for Williamson County, Tennessee

Robert and Andrea English, Franklin, Tennessee <engc205@aol.com>

On 11 July 2015, while doing an odonata species survey at the Owl's Hill Nature Sanctuary in Brentwood, Tennessee, we observed a dragonfly that we could not identify. It perched on broadleaf arrowhead and other low vegetation along the edge of a small pond. I photographed it and posted the image to the online site BugGuide.net with an identification request. You can imagine our surprise when a couple in Texas said that it looked very much like a Thornbush Dasher, *Micrathyria hagenii*. We checked one of our reference books and found that this western species has been recorded in Arkansas, but we saw no records for Tennessee.

The Thornbush Dasher was there when I returned to Owl's Hill on 13 and 14 July. I submitted the record and images to OdonataCentral and it was confirmed (OC #433072) on 14 July. We saw it for the last time on 16 July. I made the accompanying image on July 14th with a Nikon D5100 camera coupled to a Televue 85 refractor.

The odonata species survey at Owl's Hill is part of a larger year-long, all-taxa biodiversity inventory, and it certainly picked up our spirits to find this visitor. We'll never know for sure how our Thornbush Dasher arrived in Tennessee; perhaps it was storm-blown here. Time will tell if it is part of a range expansion for this species. But it's always a thrill to find something new and unexpected!

Thornbush Dasher (*Mycrathyria hagenii*), Owl's Hill Nature Sactuary, Willaimson County, Tennessee, 14 July 2015. Photo by Robert English.

The DSA Executive Council Has New Officers!

The DSA election results have been tallied. Chris Hill (Conway, South Carolina) takes the helm as our new President, moving Jim Johnson into Steve Hummel's place as Immediate Past President. Robert DuBois (Superior, Wisconsin) is the new President-Elect, and Marion Dobbs (Rome, Georgia) assumes Greg Lasley's role as a Regular Member.

A sincere thanks to all of the new EC members for their willingness to direct their time and talents towards the DSA, and an equally fervent thanks to our outgoing EC members for their service and dedication. These are the folks who keep DSA running smoothly behind the scenes. If you are interested in becoming more involved with DSA and would like to know more about the roles and duties of an Executive Council member, chat with one of our current members to find out more. New faces are always welcome!

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>.

A Dry Season Survey of the Dragonflies of St. Kitts and Nevis, Northeastern Leeward Islands

Paul M. Catling and Brenda Kostiuk <Brenda.Kostiuk@gmail.com>

With regard to their dragonfly fauna, "the lesser Antillean Islands have suffered from a general lack of knowledge" (Meurgey, 2013). This appears to be particularly true of the northeastern Leeward Islands. Most references refer to the southern islands, particularly the French West Indies including Guadeloupe and Martinique (Meurgey, 2013) and Dominica (Donnelly, 1970; Meurgey and Weber, 2007). The western Leeward Islands, i.e the Virgin Islands, have been better studied than the eastern part of the chain (Donnelly, 2002; Sibley, 1999, 2002, 2007). At the time of Meurgey's very helpful catalogue (2013), only one species of dragonfly had been reported from St. Kitts and Nevis, the Lesser Antillean endemic *Orthemis macrostigma*. However, Bass (2006; Table 1), during a study of freshwater macroinvertebrates, had reported 14 species of Odonata from the islands, although one was reported at the genus level (*Erythrodiplax*) and two were tentative (*Erythemis vesiculosa* [Great Pondhawk] and *Lestes forficula* [Rainpool Spreadwing]). All of Bass' odonate records for St. Kitts and Nevis were based on identification of nymphs, and he acknowledged R.W. Garrison for help with identification.

St. Kitts and Nevis are small islands (65 square miles, 45,000 people; and 36 square miles and 12,000 people, respectively) with volcanic peaks and vegetation zones ranging from dry coastal scrub to rainforest, cloud forest, and wet elfin woodland. Natural habitats have been substantially reduced on both islands, particularly during the period of sugar cane production and at lower elevations.

Details of the survey

Our survey of adults at 32 sites (Table 3) recorded 13 species (Table 2). It was done over a three week period (13 June to 4 July 2015) with 2–4 hours spent most days (12 days on St. Kitts and 10 days on Nevis) during an extreme dry season. At the start of the survey, the scrub and dry forest at lower elevation was brown except in low-lying areas and deep ravines (called "ghuts"). We accumulated 113 records (distinct date, location and species). Total individuals of Zygoptera (damselflies) encountered were 147. Total individuals of Anisoptera (dragonflies) were 379.

Notes on identification

Many of the records are sight records made with binoculars and a zoom-lens camera, but specimens of 36 Zygoptera and 45 Anisoptera were captured and retained as vouchers and for study. At least 50 others in each group were caught, examined, and released. For less than 5% of dragonflies we had no idea of identity. The reference to "unknown *Tramea* or B*rachymesia furcata*" could have referred to either *T. abdominalis* (Vermilion Saddlebags) or *T. insularis* (Antillean Saddlebags), or in many cases to *Brachymesia furcata* (Red-tailed Pennant). Initially we were not well-prepared to distinguish all of the red (male) dragonflies without capture, but it is not difficult. In case it is helpful we have included an illustration with ourdetailed notes in the caption (Figure 1).

Orthemis ferruginea (Roseate Skimmer) in the West Indies has long been considered distinct (Donnelly, 1995) and perhaps to contain several species (see Meurgey, 2013, p. 326 for the most recent published update). *Orthemis*

Table 1. Odonata reported from St. Kitts and Nevis by Bass (2006) based on larvae..

Species	# sites both	# sites Nevis	# sites St. Kitts
Aeshna psilus Calvert, Turquoise-tipped Darner	1	1	-
Anax concolor Brauer, Blue-spotted Comet Darner	7	6	1
Brachymesia furcata Hagen, Red-tailed Pennant	2	1	1
Brechmohoga praecox grenadensis (Kirby) (possibly *archboldi* Donnelly), clubtail	6	-	6
Dythemis sterilis sterilis Hagen, Brown Setwing	4	2	2
Enallagma coecum (Hagen), Purple Bluet	2	-	2
Erythemis, poss. *vesiculosa* (Pondhawk)	2	1	1
Erythrodiplax sp.	6	5	1
Ischnura ramburii (Selys), Rambur's Forktail	17	12	5
Lestes, poss. *forficula* (spreadwing)	5	5	-
Miathyria marcella (Selys), Hyacinth Glider	5	3	2
Orthemis sp. (poss. *ferruginea*), Roseate Skimmer	4	3	1
Pantala flavescens (Fabricius), Wandering Glider	1	1	-
Tramea abdominalis (Rambur), Vermilion Saddlebags	8	7	1

macrostigma is "the single valid species (of the genus) in the Lesser Antilles" (Meurgey, 2013, p. 327). Although only seven of 17 *Dythemis sterilis sterilis* recorded were captured and examined closely, all of these keyed to *D. sterilis sterilis* on the basis of eyes reddish-brown above in life and post–frons lacking metallic blue, etc. (Meurgey and Poiron, 2011). One or more vouchers exist for all species listed in Table 2.

Macrothemis celeno (Selys) in Sagra 1857

A single male (Figure 2) from New River Spring on Nevis (Figure 3) was found in a sunlit patch in forest beside a clear woodland stream. It keys to *M. celeno* in the key provided by May (1998). This species is endemic to the West Indies and known from the Greater Antilles where the nearest occurrence is in Puerto Rico (Meurgey, 2013). This is the first record for the Lesser Antilles. It is also the second species of *Macrothemis* to be reported in the Leeward Islands, the first being *Macrothemis meurgeyi* Daigle 2007.

The list

Considering the list of Bass and our survey, the list for both islands together stands at 18 species, including 17 for Nevis and 12 for St. Kitts. With 22 reported for the Virgin Islands and 24 from Dominica (Meurgey, 2013), it seems likely that a complete list for somewhat comparable islands of St. Kitts and Nevis would be in the upper 20s (or lower 30s). Although the dragonfly fauna of nearby Montserrat would make for an interesting comparison, the data collection for that island was not intended to be complete (Donnelly, 2007).

The habitats

Our survey included a variety of fresh and brackish habitats. We found that the habitats could be divided into three kinds based on the dragonfly fauna present. Permanent ponds were either muddy, trampled stock ponds without much vegetation (Figure 4) or ponds that were much less impacted by livestock (Figure 5) and woodland streams (springs, Figure 3). The former had only *Orthemis macrostigma,* which has been reported from a wide variety of habitats including stock ponds where few other dragonflies are present (Donnelly, 1970). Permanent golf course ponds with larger fish had fewer dragonflies and dragonfly species than temporary or semi-temporary ponds without fish or with smaller fish (Figure 5). Most of the species recorded were associated with open habitats, but *Erythrodiplax umbrata* (Band-winged Dragonlet) and females of *Micrathyria aequalis* (Spot-tailed Dasher) occurred in semi-open moist or swampy woods away from water. Although streams were mostly dry as a result of

Figure 1. Three species of mostly red male libellulids that can be distinguished without capture. All specimens photographed were from the cattle reservoir on St. Kitts (Fig. 2) SW of Monkey Hill, 20–23 June 2015. Top: *Brachymesia furcata* (Red-tailed Pennant) is the smallest; S2 and S3 swollen basally; pale brown bands at base of hindwings. Middle: *Tramea abdominalis* (Vermilion Saddlebags): black marks on the dorsal surface of S8 and S9; very dark brown bands at base of hindwings. The very similar *T. insularis* (Antillean Saddlebags; not shown) has a black face and metallic violet forehead instead of a red face and forehead as in *T. abdominalis* (Dunkle 1989). *T. calverti* (Striped Saddlebags; not shown) is similar but has a striped thorax. Bottom: *Orthemis macrostigma* is the largest with thorax red or pale blue to red-violet; no bands on basal hindwings; abdomen may be red or pinkish-red; immature males may have white stripes on the thorax. *Crocothemis servilia* (Scarlet Skimmer; not shown) is also all red, but it has an amber spot at the hindwing base that *O. macrostigma* lack. *C. servilia* has not been recorded on the Lesser Antilles, but occurs on the Greater Antilles including nearby Puerto Rico. This figure and notes do not account for all *Tramea* reported from the Lesser Antilles (Meurgey, 2014). *T. binotata* (Sooty Saddlebags) and *T. lacerata* (Black Saddlebags) males have a mostly black abdomen; *T. onusta* (Red Saddlebags), previously known from the Virgin Islands, has a more extensive and irregular margined basal band. See text for other notes on *Orthemis*.

the season and water travelling underground through lava tubes or porous rock, some streams remained open for a short distance near springs, often (but not always) at higher elevation on volcanoes, the tops of which are mostly enshrouded in cloud. The clear pools in shady forest below small waterfalls were a habitat for *Dythemis sterilis sterilis*, *Enallagma coecum*, and *Macrothemis celeno*.

Comparison of the islands

The sample is too small to justify a reliable comparison of the islands. Furthermore, our effort on St. Kitts was a little

less and not as well-organized than that on Nevis. Nevertheless, some observations are worthy of further investigation (see Table 2). For example, *Brachymesia herbida* (Tawny Pennant) was fairly frequent on Nevis but there were no records for St. Kitts. *Brachymesia furcata* was more common on St. Kitts than on Nevis.

Status of the species

As in Bass' (2006) survey of larvae, the most abundant odonate species was *Ischnura ramburii* (Rambur's Forktail). The next most abundant species were *Erythemis vesiculosa* and *Erythrodiplax umbrata*. The species of running streams were the least abundant, as was their habitat. There were an estimated 15 ponds that were not visited on Nevis and that many also on St. Kitts, but only 2–3 running streams were known in the dry season on either island, so this habitat appears to be a high priority for protection. Although the pools on these streams might accommodate some bathing by hikers without negative impact, increased water removal from the source areas is a concern for a diverse and possibly partially endemic mountain stream fauna.

Additional Work

Much more information will be gathered before a satisfactory understanding of the odonate fauna of St. Kitts and Nevis is achieved. Since some of these dragonflies feed on both larval and adult stages of the mosquito species that vector dengue fever and chikungunya, their ecology deserves more study. Also, future surveys will place more emphasis on the higher elevation and stream habitats

Figure 2. *Macrothemis celeno* (Antillean Sylph) male from New River Spring, Nevis, 1 July 2015. Dorsal, lateral anterior, and face. This is the first record of this West Indian endemic in the Lesser Antilles.

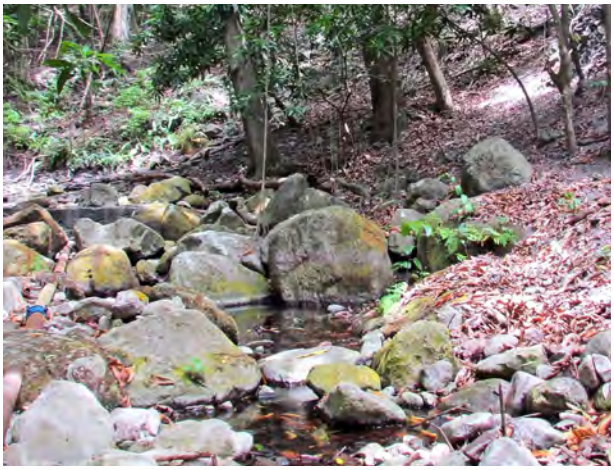

Figure 3. A running portion of the stream at New River Spring during the dry season; Nevis, 1 July 2015.

Figure 4. A stock pond on Nevis frequented by cattle, pigs, sheep and goats and several *Orthemis macrostigma*. Almost all emergent vegetation is trampled but the floating *Pistia stratiotes* provides cover for ubiquitous *Ischnura ramburii* (Rambur's Forktail).

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Figure 5. Cattle reservoir on St.Kitts SW of Monkey Hill, 20 June 2015. Cattle are prevented from having much influence as the wall prevents trampling and defecation. The water is clear, with submerged vegetation (which is limited by the cattle) and small fish. This pool was remarkably attractive to a diverse dragonfly assemblage with 20 present at a time among six species: *Brachymesia furcata* (Red-tailed Pennant), *Erythemis vesiculosa* (Great Pondhawk), *Erythrodiplax umbrata* (Band-winged Dragonlet), *Orthemis macrostigma* (Antillean Purple Skimmer), *Pantala flavescens* (Wandering Glider), and *Tramea abdominalis* (Vermilion Saddlebags).

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Table 2. Number of sites and number of individuals recorded for 13 species of Odonata during a dry season survey from 13 June to 4 July, 2015.

Species	Nevis # of sites	Nevis # indiv.	Kitts # of sites	Kitts # indiv.	Both # of sites	Both # indiv.
ZYGOPTERA (DAMSELFLIES)						
Ischnura ramburii (Selys), Rambur's Forktail	13	119	3	28	16	147
Enallagma coecum (Hagen), Purple Bluet	2	43	-	-	2	43
ANISOPTERA (DRAGONFLIES)						
Brachymesia furcata Hagen, Red-tailed Pennant	2	13	6	33	8	46
Brachymesia herbida Gundlach, Tawny Pennant	6	34	-	-	6	34
Dythemis sterilis sterilis Hagen, Brown Setwing	3	17	-	-	3	17
Erythemis vesiculosa (Fabricius), Great Pondhawk	12	66	1	5	13	71
Erythrodiplax umbrata (Linnaeus), Band-winged Dragonlet	9	67	2	23	11	90
Macrothemis celeno (Selys) in Sagra, Antillean Sylph	1	3	-	-	1	3
Micrathyria aequalis (Hagen), Spot-tailed Dasher	6	11	-	-	6	11
Orthemis macrostigma (Rambur), Antillean Purple Skimmer	12	46	1	5	13	51
Pantala flavescens (Fabricius), Wandering Glider	2	4	8	10	10	14
Tramea abdominalis (Rambur), Vermilion Saddlebags	1	8	1	5	2	13
Tramea insularis, Antillean Saddlebags	2	1	-	-	2	1
Unknown *Tramea* or *Brachymesia furcata*	9	27	1	1	10	28

Table 3. List of locations surveyed for dragonflies on St. Kitts and Nevis on 13 June to 4 July, 2015.

	Island	Location	latitude	longitude
1	St. Kitts	Bayford Estate	17.3358	-62.7355
2	St. Kitts	Behind Monkey Hill	17.3190	-62.7413
3	St. Kitts	Southwest of Monkey Hill, north of circle	17.3067	-62.7406
4	St. Kitts	West end of Salt Pond, Frigate Bay	17.2844	-62.6884
5	St. Kitts	Cattle reservoir, Southwest of Monkey Hill	17.3073	-62.7422
6	St. Kitts	Wingfield River at Romney Manor	17.3280	-62.7994
7	St. Kitts	Golf Course Pond at Frigate Bay	17.2860	-62.6873
8	St. Kitts	Near Greatheads Pond	17.3168	-62.6977
9	St. Kitts	Salty pond, Christophe Harbour, NE end of Great Salt Pond	17.2460	-62.6437
10	St. Kitts	Dudon (Dos D'Anse) Pond at 945 m	17.3576	-62.7893
11	Nevis	Pond on south side of airport	17.2062	-62.5844
12	Nevis	Nelson Spring	17.1755	-62.625
13	Nevis	Pond at Pond Hill	17.1291	-62.5826
14	Nevis	Swimming pool at Montpelier Resort	17.1232	-62.5904
15	Nevis	Dry temporary pond, north side of Charlestown, Pinney Hotel	17.1470	-62.6269
16	Nevis	Camp Spring	17.1898	-62.5779
17	Nevis	Golden Rock garden pools	17.1431	-62.5665
18	Nevis	Ditch on south side of Charlestown, Main Road	17.1319	-62.6188
19	Nevis	Small stream with pools above baths at Bath Springs	17.1329	-62.6264
20	Nevis	Mouth of Bath Creek and Gallows Bay Woods	17.1331	-62.6309
21	Nevis	Remnants of ponds, mouth of Sulphur Ghut	17.1226	-62.6275
22	Nevis	Creek on Fountain Village Rd. above Camp Spring	17.1846	-62.5851
23	Nevis	Springhill Pond	17.1785	-62.5963
24	Nevis	Botanical Garden pools	17.1227	-62.5947
25	Nevis	Pool at mouth of Bridge Ghut S of Long Point Harbour	17.1047	-62.6153
26	Nevis	Golf Course Ponds	17.1596	-62.6270
27	Nevis	New River Spring	17.1498	-62.5574
28	Nevis	New River Estate cattle reservoir	17.1488	-62.5486
29	Nevis	Waterfalls above Prison Farm at 350 m	17.1652	-62.5782
30	Nevis	Pool beside Sunshine's at Pinney Beach	17.1519	-62.6272
31	Nevis	Nisbet Ponds	17.2071	-62.5797
32	Nevis	Mango Pond S of Four Seasons	17.1619	-62.6266

First Record of the Thornbush Dasher (*Micrathyria hagenii*) for Oklahoma

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During a visit to The Nature Conservancy's J.T. Nickel Preserve in Cherokee County, Oklahoma on 3 July 2015, we found the first state record of the Thornbush Dasher (*Micrathyria hagenii*). We located eight male dashers, but we could not find any females. We collected two of the males (specimens, SP 1695 and SP 1696, in the Smith-Patten/Patten Collection [SP]; photos of SP 1695 submitted to Odonata Central [OC] as record number OC 432602; Fig. 1) and photographed others. Michael A. Patten [MAP] returned to the site on 5 July, at which time he checked multiple ponds in the vicinity of the original location and checked nearby grassy areas in hopes of stirring up females. He found seven males (1 collected as SP 1700) at the original pond, but again no females. Bill Carrell returned to the site on 14 July. He conducted a similar intensive survey to that done on 5 July but he was unable to find any Thornbush Dashers. Jim Arterburn was just as unlucky when he checked the pond on 31 July.

The J.T. Nickel Preserve is located in the Ozark Plateau. The pond where the Thornbush Dashers were found is a small (approximately 30 m^2), man-made impoundment. The pond is situated in a pasture that was previously planted in tall fescue (*Festuca arundinacea*), an introduced species, but is being restored to tallgrass prairie vegetation. The habitat in the pond consisted of open-water and submersed vegetation, primarily Canadian waterweed (*Elodea canadensis*) and humped bladderwort (*Utriculria gibba*), and emergent species on the periphery such as blue mudplantain (*Heteranthera limosa*), squarestem spikerush (*Eleocharis quadrangulata*), and Kansas arrowhead (*Sagittaria ambigua*).

We visited the pond in hopes of collecting specimens of the Amber-winged Spreadwing (*Lestes eurinus*), a species that was added to the Oklahoma state list in 2013 (a single female, SP 688, OC 400672, Pushmataha Co.; Patten and Smith-Patten, 2013). The second state record of the spreadwing was found the following year at the Nickel Preserve by Jim Arterburn (OC 423037, June 2014). Later in 2014 and earlier this year the species appeared at nearby ponds (OC 424690, July 2014, and OC 431433, June 2015). We were fortunate that the day before our visit to the Nickel Preserve we found another population (or likely population, as only males have been seen thus far; one male collected as SP 1688) in the Adair County portion of Cookson Wildlife Management Area; nonetheless, we still wanted vouchers of the Cherokee County population. To our dismay we found no spreadwings, Amber-winged or otherwise, at the pond (or any nearby) but we were, of course, thrilled to stumble across the Thornbush Dashers.

Admittedly we were quite puzzled by finding Thornbush Dashers in northeastern Oklahoma. Although BS-P predicted the species would be found in Oklahoma, she predicted it to show in southern Oklahoma, likely in the southcentral or southwest. Upon looking more closely at the range map (Paulson, 2009), the northeastern Oklahoma record, though still surprising, is not so terribly shocking. There is one record of the species reported for northwestern Arkansas, also in the Ozark Plateau: a single specimen, gender unspecified, that was collected on 8 June 1968 in Franklin County (Houston, 1970; Harp and Rickett, 1977). This specimen, collected some 100 km (63 mi) southeast of the Oklahoma locality, has not been located and we (and George Harp, pers. comm.) have been unable to contact the author of the record. Until that record can be verified, we suggest it be treated with caution.

With or without the Arkansas record as context, the northeastern Oklahoma record remains somewhat of a puzzler. If we consider that the Oklahoma pond is some 650 km (400 mi) northeast of where the species breeds regularly in Texas and 400 km (250 mi) from the northernmost Texas record, the obvious question, then, is how did a group of male Thornbush Dashers end up so far from where they normally occur (Fig. 2)? The question came up again eleven days after the Oklahoma dasher find when the species was discovered in Tennessee (Owl's Hill Nature Sanctuary, Brentwood, Willamson Co., Robert English, 14 July 2015, OC 433072; see note in this issue). Such long-distance displacement or dispersal of organisms is not unheard of, and certainly we have seen it several times with North American odonates; for example, Twilight Darner (*Gynacantha*

Figure 1. Thornbush Dasher (*Micrathyria hagenii*) found at the J.T. Nickel Preserve, Cherokee County, Oklahoma, on 3 July 2015. This male was collected as specimen SP 1695.

nervosa), Persephone's Darner (*Aeshna persephone*), Tawny Pennant (*Brachymesia herbida*), Great Pondhawk (*Erythemis vesiculosa*), and Evening Skimmer (*Tholymis citrina*; Paulson, 2009).

Long-distance dispersals happen for various reasons, some active and others passive. We tend to be more familiar with the active forms, such as migration, because we have heard much about birds and monarch butterflies, for instance, migrating south for the winter and returning in the spring. And in recent years, many of us have also become aware that even some odonates migrate (<http://www.migratorydragonflypartnership.org>). But active dispersal does not have to be associated with migration; it can just be that an animal moves to find food, to avoid temperature extremes, or for reasons that scientists have yet to discern. Passive dispersal, on the other hand, is less well known. Both plants and animals can disperse passively via wind, water, or by being transported by animals, including humans. Passive dispersal by storms is a long-held notion (Webster, 1902; Wood Jones, 1909; Felt, 1925; Darlington, 1938; Holzapfel and Harrell, 1968), although a largely untested one (Gillespie et al., 2012).

Thinking about the Oklahoma and Tennessee records of the Thornbush Dasher leads one to ponder whether those individuals actively or passively arrived at the localities where they were discovered and to further question the dispersal mechanism. The Thornbush Dasher is generally not considered a migratory species or a really strong flier, so it seems unlikely that the species would have actively dispersed. Although perhaps these two extralimital records reflect an especially good breeding season in which individuals dispersed much farther than normal. However, the distance traversed is rather great, especially when considering the distance between the normal breeding range and the Tennessee record (over 1,100 km [700 mi]).

An arguably more plausible scenario lies in the weather, specifically Tropical Storm Bill (which was initially suggested by MAP as the dispersal mechanism). Looking at the track of the storm and the outflow bands (Figs. 2 and3) it is easy to construct a beautiful story that a horde of Thornbush Dashers were scooped up in Texas and sent on their way to northeastern Oklahoma and central Tennessee via high-powered winds. Although this is reasonable conjecture, unfortunately researchers have yet to come up with a way to test the hypothesis of passive dispersal by storms (Gillespie et al., 2012). Gathering evidence to test such a hypothesis is formidable, and would require a researcher to know when a storm was coming, somehow to GPS tag insects, and then track them before, during,

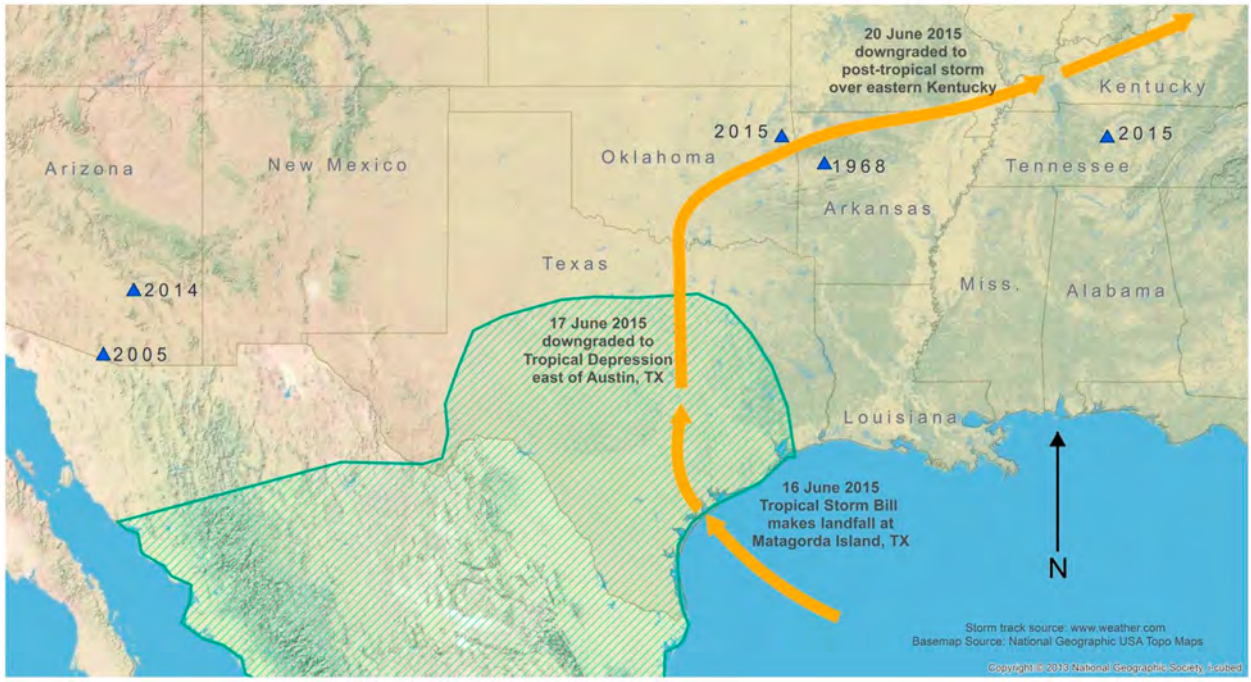

Figure 2. Species range for the Thornbush Dasher (*Micrathyria hagenii*) in northern Mexico and the southern United States (hatched green; Mexico range approximated from Paulson & González Soriano, 2015 and Doug Danforth, pers. comm.; Paulson, 2009). Extralimital records for Arizona, Arkansas, Tennessee, and Oklahoma are shown with year of record. In June 2015 Tropical Storm Bill tracked through eastern and central Texas, where the Thornbush Dasher breeds, into Oklahoma and onto the east, affecting Tennessee and Kentucky, where it finally was downgraded to a post-tropical storm. The tropical storm is one of the dispersal mechanisms that may explain the presence of Thornbush Dashers in Oklahoma and Tennessee.

and after a storm, to determine how many individuals were sucked into the storm (ideally also where in the storm they were carried and how they were released from the storm), how many survived the storm, and where they ended up after they were released from the storm. Nonetheless, Tropical Storm Bill may be a plausible explanation for the Oklahoma and Tennessee records.

Other extralimital records for the species do not fare so well under the storm hypothesis. The Arkansas record in particular is problematic because there were no storms in 1968 (Stark, 1968; Green, 1968) that would explain that occurrence. The Arizona records fare a little better. The species was first found in Arizona in late September 2005 when Rich Bailowitz found several at a pond at the Buenos Aires National Wildlife Refuge, Pima County (Bailowitz specimen; Doug Danforth, pers. comm.). Bailowitz returned to the site a few days later, on 26 September 2005 with Doug Danforth, who photographed the species. They found an additional individual on that same day a few miles away from the original location. The species was found again on 1 November 2014, this time at The Nature Conservancy ponds near Dudleyville, Pinal County (Justin Jones, OC 427607, and also photographed by Pierre Deviche). During 2005 and 2014 there were tropical storms and hurricanes on the Pacific coast of Mexico (NOAA 2006, 2015) that theoretically could have pushed Thornbush Dashers northward, but the storms did not directly track through Arizona as Tropical Storm Bill did with Oklahoma and Tennessee. We also do not have a clear idea of the species' range in Sonora, so the apparent gap between the Guaymas area in central Sonora, where the species is known to be rather common (Doug Danforth, pers. comm.), and southern Arizona may be simply an artifact of survey effort, whereas the gap between central Texas, where Thornbush Dashers breed, and northeast Oklahoma is much better documented as a true gap.

Whether brought northward passively, via a storm, or actively, via regional dispersal, perhaps due to climate change, what remains to be seen is whether these extralimital records are an indication of a range expansion of the Thornbush Dasher or if they are just random records. Latitudinal range shifts and expansions have been documented for a wide variety of organisms, including odonates (e.g., Hickling, 2006; Menéndez, 2007; Walther et al., 2002.). There have also been specific discussions regarding Neotropical odonates, i.e. *Chyrsobasis* [*Leptobasis*]*lucifer* (Lucifer Swampdamsel), *Lestes forficula* (Rainpool Spreadwing), *Nehalennia minuta* (Tropical Sprite), *Orthemis discolor* (Carmine Skimmer), *Erythemis vesiculosa* (Great Pondhawk), *Micrathyria hagenii*, *Tholymis citrina* (Evening Skimmer), and *Tramea calverti* (Striped Saddlebags) expanding their ranges into, or further into, the United States (Behrstock, 2000; Paulson, 2001).

Figure 3. Satellite image of Tropical Storm Bill (National Oceanic and Atmospheric Administration graphic).

For Texas, we know that the Thornbush Dasher was present in the Rio Grande Valley at least as early as 1905 (University of Kansas specimen, SEMC 1326749, Brownsville, Cameron Co., coll. by Francis Snow; Eaton and Calvert, 1892–1908). We also know that Needham (1943) commented that he tried to find the species there, but was unable to, although he did not indicate the level of survey effort. The species is currently fairly common in Texas from the border with Mexico, north to the Austin area (John C. Abbott, pers. comm.). It is often difficult to tease apart range expansions from level of effort in documenting ranges, but perhaps the Thornbush Dasher will prove to be a good case study.

And finally, whether we simply overlooked females or there really were none present will remain to be seen. It is certainly disheartening to discover that the males were only present at the Oklahoma pond for a few days for sure but no more than about a week and a half at the longest. Such a duration does not fare well for founding a population in northeastern Oklahoma. Nonetheless we do suspect that one day the species will colonize the southern part of the state.

Acknowledgements

We thank Doug Danforth, George L. Harp, and John C. Abbott for information on the Arizona, Arkansas, and Texas records, respectively. We also thank Davis Pritchett for his help in trying to track down the Arkansas specimen and its collector. Many thanks to Jennifer Thomas, Collections Manager at the Snow Entomological Museum, for providing data on the Brownsville, Texas, specimen.

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First Records of *Sympetrum madidum* (Red-veined Meadowhawk) in Wisconsin

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On 12 July 2007, Todd took a photograph of an unusual looking male *Sympetrum* (meadowhawk) as it was perched on a gravel road in the Sandhill State Wildlife Area (SSWA) in central Wisconsin (Wood County; Figure 1). It was later determined to be *S. madidum* (Red-veined Meadowhawk; confirmed by Dennis Paulson), a western species, and is the first state record for the species in Wisconsin. Subsequent visits to SSWA by a number of odonatists have failed to find a breeding site there for *S. madidum* or turn up any more specimens. On 20 July 2014, Ryan took a photograph of a female *Sympetrum* on a private driveway just outside of the Town of Washburn in northern Wisconsin (Bayfield County; Figure 2). This individual was also later determined to be *S. madidum* (confirmed by Scott). No other specimens of *S. madidum* have since been recorded at this site either, despite extensive searches. The Bayfield County record is about 270 km north of the Wood County record and slightly west of it.

Figure 2. *Sympetrum madidum* (Red-veined Meadowhawk) female photographed in Bayfield County, Wisconsin.

Both Wisconsin records of *S. madidum* were photographed at sites at least 350 km east of the nearest area where multiple individuals and breeding behavior have been documented by Scott, which is in the Tallgrass Aspen Parkland (TAP) biome in eight northwestern Minnesota counties (<http://prairiebioticresearch.org/Reports/S_madidum_report(12-15-12).pdf>). On 13 July 2012, Scott filmed ovipositing behavior in this biome in Roseau County (<https://www.youtube.com/watch?v=NR5dWJ0vvPA>). A few other isolated individuals round out the eastern-most records of *S. madidum*. On 13 July 2008, Kim Mann photographed a male on a gravel road near Laclu at the far western edge of the province of Ontario. On 10 July 2012, Ken Tennessen observed a male in a roadside ditch in northern Lake of the Woods County, Minnesota, and on 28 July 2014, Scott found a female on a gravel road a bit to the east of the other Minnesota records, at the east end of Upper Red Lake, near Waskish in Beltrami County.

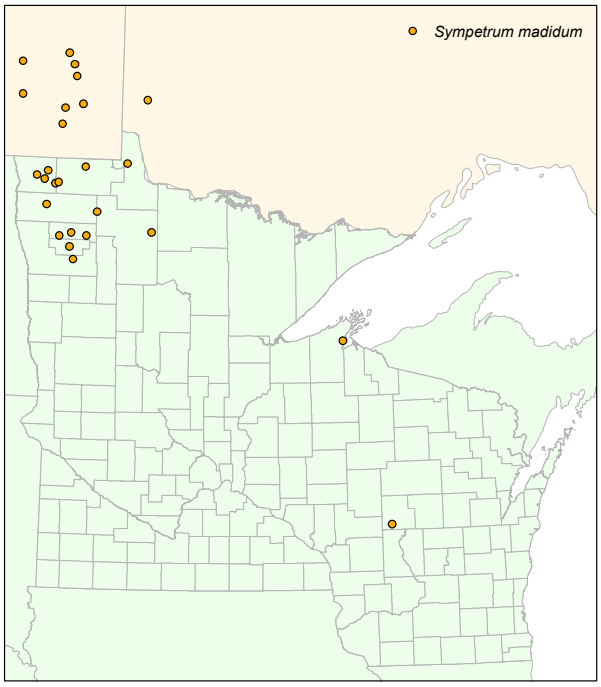

Figure 1. Eastern-most records of *Sympetrum madidum* (Red-veined Meadowhawk), which are located in Wisconsin, Minnesota, and in Canada in southwest Ontario and southeast Manitoba. Map by Molly Wick.

We have no evidence of successful breeding of *S. madidum* in Wisconsin and consider the two individuals reported here to have been vagrants. However, we do note some similarity between the TAP biome, where breeding has been documented, and the SSWA, in that both areas have partly open landscapes that were influenced by large glacial lakes. *S. madidum* is not known to be migratory, but life history information for it is scant, and *S. flaveolum* (Yellow-winged Darter), which seems most similar to it morphologically and genetically (Pilgrim and Von

Dohlen, 2012), is known as an irregular migrant in Europe (<http://www.british-dragonflies.org.uk/species/yellow-winged-darter>). Although Wisconsin lies well east of the known breeding range for *S. madidum*, the real possibility of finding vagrants/migrants in this state means that specimens and photographs that don't look quite right for any of Wisconsin's better-known species of *Sympetrum* should be carefully examined. The numerous records of *S. madidum* in Minnesota, and two records in Wisconsin, all within the last 10 years, coincide with increased Odonata survey activity in both states during that time. It is not known if increased surveying alone explains these recent records, if the species is occasionally migratory, or if it is expanding its range eastward.

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The End of One—A Meal for Another

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Tiger beetle larvae live in narrow burrows and operate from the mouths of these burrows as sit-and-wait predators. Several authors mention Anisoptera (dragonflies) as larval prey (Corbet, 1999: p. 328; Knisley and Schultz, 1997: p. 32 [*Anax*]; and Smith, 2000 [*Gomphus*]; Larochelle, 1976 also wrote about odonates as prey for tiger beetles but I haven't seen this paper). It seems that Zygoptera (damselflies) should be far more common as prey than Anisoptera. While the potential area for contact with tiger beetle larvae is smaller since Zygoptera are smaller and thinner, Zygoptera are weaker and generally far more abundant than Anisoptera. As a result tiger beetle larvae, even the smaller ones, should have more opportunities and more success in capturing Zygoptera. For colonies of tiger beetle larvae occupying patches of relatively open sand along shorelines, Zygoptera which rest on the ground may form a significant, although sporadic, source of food.

Figure 1: Looking northwest along New River. The edge of the patch of sand with the larval colony is just visible behind the base of the small bank on the right. The dunes in the background form a narrow strip that separates the river from the ocean.

Recently, while walking along the shore of New River in the Storm Ranch section of the New River Area of Critical Environmental Concern in southern Coos County, Oregon, I came across small patch of relatively open sand (6–9 square feet) at the base of a small bank (Figure 1), home to a small colony of larval tiger beetles, likely *Cicindela oregona* (Western Tiger Beetle). While I occasionally find adults of *Cicindela bellissima* (Pacific Coast Tiger Beetle) and *Cicindela hirticollis siuslawensis* (Siuslaw Hairy-necked Tiger Beetle) in the same general area, *Cicindela oregona* adults are very common and can be found most of the year. Judging from my images and the diameters of the larval burrows (~1.5 mm and ~2.5 mm), the colony consisted only of first and second instar larvae (Figure 2).

Sticking out of one of the small burrows was a damselfly, *Enallagma* sp. (likely *E. annexum*, Northern Bluet), with several segments of its abdomen down in the hole and its head missing. A roaming ant came by and began working on the remains.

I returned to the same area two weeks later. An *Enallagma* resting on the sand seemed to be having problems–it was squirming around a lot but seemed unable to get off the ground even though it had no apparent injuries. I pinched its wings together and lifted it up, after which it flew away. There was some slight resistance when I lifted it up. Afterwards, I noticed some activity in the sand from a tiger beetle larva that had been right under the thorax of the now-free damselfly. In the photograph I had taken beforehand, I saw what appeared to be a small claw wrapped around the femur of the damselfly's hind leg.

Shortly after that, a second *Enallagma* landed on the sand and most of its abdomen quickly disappeared down a hole. The rest of its abdomen disappeared shortly there-

Figure 2: Second instar tiger beetle larva sitting at the mouth of its burrow in the sand.

after. Immersion was stopped mainly by the wings, which splayed out on the sand behind the damselfly (Figure 3). The thorax did seem to be bigger than the hole, but it is unclear if that would have posed a significant obstacle to pulling the damselfly down even further, although the legs might have prevented this.

Stuck in the hole, the damselfly used its front and middle legs to agitate the sand in front of it, often fluttering its wings at the same time, probably in an effort to gain some traction and escape. At times, however, this activity would end and the damselfly would raise one foot to its mouth and begin chewing. It looked as though the damselfly was feeding on something it found, although, other than sand, I didn't notice anything obvious near it in my pictures. Perhaps this was some kind of stress behavior.

During this time, the damselfly was attacked three times from the side and the front by hunting *Cicindela oregona* adults. It was able to fend off each attack successfully using its legs and wings (Figure 4). Death came on the fourth attack, when a mating pair of adults attacked from behind. It is probable that by this time the damselfly was wounded and/or weakened, but by attacking from behind, the pair effectively nullified the damselfly's defenses. The female tiger beetle locked her jaws around the damselfly's neck (Figure 5) and was able to rip/pry/cut its head off. She then moved off to consume the head while several other adults came in and worked on the thorax. After the female was finished the pair came back to work on the remains of the thorax some more.

The whole drama from capture to death lasted about an hour.

Figure 3 (top): Damselfly with abdomen in tiger beetle burrow. Figure 4 (middle): Damselfly trapped in larval tiger beetle burrow fending off a frontal attack by an adult tiger beetle. Figure 5 (bottom): The female half of a mating pair of tiger beetles working to decapitate a trapped damselfly.

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First Records for *Rhionaeschna multicolor* (Blue-eyed Darner) and *R. mutata* (Spatterdock Darner) in Minnesota and Wisconsin, and Their Overlapping Ranges in These States

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Most records of *Rhionaeschna multicolor* (Blue-eyed Darner) and *R. mutata* (Spatterdock Darner) in Minnesota and Wisconsin are recent. Except for an adult *R. multicolor* collected in Clearwater County, Minnesota in 1960 and the records of a number of *R. mutata* from a cluster of small ponds in Marquette County, Wisconsin, in 1989, all other records of these species have come during the last eight years. Prior to 2009, the western limit of the range of *R. mutata*, an eastern North American species, was located in east-central Wisconsin. This species requires shallow, usually fishless ponds, often with extensive coverings of water lilies (including spatterdock [*Nuphar* spp.]).

Prior to 2007, the eastern limit of the range of *R. multicolor*, a western North American species, was located in eastern Iowa (Allamakee County; date and location not available from OdonataCentral [OC]). Throughout its range, *R. multicolor* occurs at a variety of productive lakes, ponds, and slow streams, often in open areas. Until recently, the known ranges of these two species were separated by about 160 km. However, a spate of records in the last eight years of both species in both states has changed this picture and they are now known to have overlapping ranges, though not habitats, from central Wisconsin to eastern Minnesota (Figure 1). This note chronicles the recent discoveries of these two species in this strikingly colored genus (Figure 2) in these states.

First Record and Current Distribution of *R. multicolor* in Minnesota

On 15 June 1960, K.C. Kim collected the first specimen of *R. multicolor* in Minnesota in Clearwater County (exact location not recorded). No other *R. multicolor* were recorded for 50 years until 2010, when Scott King saw a male on 30 June, collected a male and saw another on 7 July, and netted another and saw at least a dozen on 21 July, all at Lake Byllesby Regional Park (LBRP) in Dakota County. Although no breeding was observed, the many individuals present suggested that *R. multicolor* might have been breeding in LBRP in 2010. However, Scott has not seen the species there since, despite numerous visits each year. Two additional adult specimens collected in 2012, one by Kurt Mead on 25 June at Falcon Heights Community Park in Ramsey County, and one by Jeff Fischer on 28 June at a field in Hennepin County, complete the records of *R. multicolor* in Minnesota. In 2007, Ken Tennessen determined a nymph collected at a lake in Polk County as *R. multicolor*, but it was not reared to confirm the identification.

The paucity of records of *R. multicolor* in Minnesota is puzzling given the abundance of apparently appropriate habitats and the great increase in Odonata survey effort there during the last decade. We suspect that *R. multicolor* is more widely distributed in the western Minnesota than is now known, and that more surveying would reveal more populations.

First Record and Current Distribution of *R. multicolor* in Wisconsin

On 27 July 2007, Denny and his wife Renee were sampling odonates along a shallow bay of Half Moon Lake in the City of Eau Claire, Eau Claire County, when they netted several darners with blue eyes that were flying over a stand of cattails. They collected one male and tentatively

determined it to be *R. multicolor*. Bill soon confirmed the determination of this first record for Wisconsin. Over the next two weeks, Denny, sometimes in company with Renee, Bill, or Bob, made seven more trips to the site, seeing one or more *R. multicolor* cruising over the cattail stand on all but two of the trips. Several trips to the site in August 2007 to find exuviae and again in November 2007 to kicknet for nymphs were not fruitful. Many visits to this site by Denny and Ryan during summer months in subsequent years have resulted in observations of dozens of *R. multicolor*, a number of which were netted. However, no nymphs or exuviae were ever found at this site despite extensive collection efforts.

From 2008 through 2012 we learned that Half Moon Lake was not the only Wisconsin site for *R. multicolor*, as Denny observed more adults near small ponds (< 1 ha) within several golf courses in the City of Eau Claire. Nor was Eau Claire the only county to have them. On 10 July 2008, Dave Hanson collected a male struck by his car in Trempealeau County. On 10 July 2010, Dan photographed a male at Sidie Hollow Lake in Vernon County, and on 5 August 2012 Dan photographed another male at Keip's Island Canoe Landing in Trempealeau County.

Despite a growing number of sightings at many sites from 2007 through 2012, there was still no firm evidence of *R. multicolor* breeding in Wisconsin. But that was finally about to change. In the summer of 2012, Renee noticed a number of *R. multicolor* flying near a retention pond near South Junior High in the City of Eau Claire. On 7 June 2013, Denny and Bob sampled the pond and collected six nymphs of *R. multicolor*, reared five of them, and found three unassociated exuviae. Denny and Bill revisited the site on 17 June 2013 and found more exuviae.

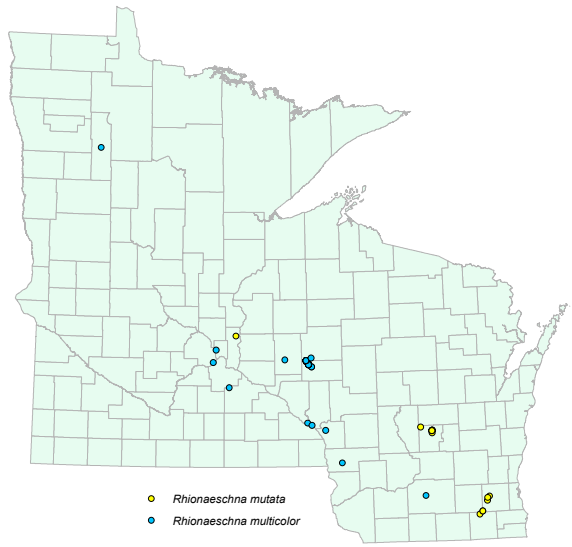

Figure 1: Current distribution records of *Rhionaeschna multicolor* (Blue-eyed Darner) and *R. mutata* (Spatterdock Darner) in Minnesota and Wisconsin.

From 2013–2015, additional sites with *R. multicolor* have continued to turn up in west- and south-central Wisconsin. In 2013, from 12 July to 8 October and in 2014 from 9 July to 19 September, Ryan and his wife Carey made many trips to several ponds in the Truax Prairie, Eau Claire County, about 5 km northwest of the City of Eau Claire, and saw one or several *R. multicolor* males flying at these ponds on 17 occasions. Several were netted to confirm identifications. In the summer of 2013 Ryan recorded males at several other sites around the City of Eau Claire, where this species seemed to have a solid foothold. On 25 July 2013 in Chippewa County and on 4 August 2013 in Dunn County, Ryan observed a number of *R. multicolor* near small ponds on private land. On 12 October 2013, Edgar Spalding photographed a male and observed a few others cruising around Stricker's Pond in the City of Madison, Dane County, which extended the range of *R. multicolor* about 130 km to the east. Edgar photographed another male at the same site on 22 June 2015 which suggests that a population is persisting there. On 31 July 2014, Alon Coppens photographed a male at a small pond in the Wisconsin River floodplain in Chippewa County. On 5 June 2014, Dan netted a female near a private retention pond in the Town of Holman in LaCrosse County. Dan had surveyed this pond consistently since 2009 and had never seen *R. multicolor* there previously. During summer of 2015 Dan observed, netted, and photographed *R. multicolor* at this pond on a number of occasions, and observed females ovipositing several times, which suggests that a population has recently become established.

Now documented from at least 14 sites in seven Wisconsin counties, *R. multicolor* appears to be secure in cattail-rimmed small ponds and shallow lake bays, mostly in the west-central counties, but also in south-centrally located Dane County. The recent increase in records of this species could be due to increased surveying in Wisconsin in recent years or to an expansion of the range of *R. multicolor* to the east. The recent apparent establishment of a population in LaCrosse County suggests the latter. The kinds of habitats favored by *R. multicolor* are well-distributed in many parts of Wisconsin, so it seems likely that more sampling in appropriate habitats would reveal more breeding sites. Wisconsin specimens of *Rhionaeschna* are housed in the Wisconsin Odonata Collection (managed by Bob) at the DNR Service Center in Superior.

First Record and Current Distribution of *R. mutata* in Minnesota

In early June of 2009, Ron collected a male *R. mutata* as it

patrolled the margin of a 2.2 ha raised bog in east-central Minnesota. This was the first record for this species in the state. The nymphal habitat requirements for *R. mutata* are known to be quite narrow, including wooded, fishless ponds with some cover of water lilies, particularly yellow water lily (spatterdock). These key habitat preferences were used by Ron to identify two shallow ponds as potential breeding sites near the point of capture of the adult specimen. Surveys of these ponds by Ron and Bill during the fall of 2009 resulted in the collection of 21 nymphs of *R. mutata*. Subsets of these nymphs were reared to adults during the winter of 2009–2010 to confirm identification. Adults, nymphs, and exuviae have been observed and collected at both of these ponds for the past six years. This population establishes a substantial northwestern extension of the range of this species, and it remains as the only known cluster of breeding sites in Minnesota.

Figure 2: Eye to eye with a Blue-eyed Darner (*Rhionaeschna multicolor*) from Eau Claire County, Wisconsin. Photo by Ryan Chrouser.

R. mutata is clearly seriously imperiled in Minnesota where breeding sites are known only in a couple of small ponds in northeastern Washington County. Further, the populations in these ponds appear to have become substantially depressed in just the last few years, so a study to elucidate the cause(s) of this apparent decline has been initiated.

First Record and Current Distribution of *R. mutata* in Wisconsin

The first Wisconsin records of *R. mutata* were made by Bill, his son Corbin (who found the first one), and Tim Vogt on 4 June 1989 when they collected a teneral, several dozen exuviae, and 3 F-0 nymphs at Stoick's Pond in northern Marquette County. This pond was small and shallow, with an open water rim and floating mat of peat in the middle, and with an abundant growth of spatterdock. Subsequent visits to Stoick's Pond and two other nearby ponds in June and early July of 1989 by Bill and Tim Vogt found more adult *R. mutata*, several of which were collected. However, recent visits by Bill to Stoick's Pond have not documented a persisting population and the character of the pond has changed from having lots of spatterdock to having a dense stand of wild rice (*Zizania palustris*), a change that does not appear to favor *R. mutata*. There is now a residential dwelling near shore that was not present in 1989; it is not known if the change in habitat in the pond was caused by human activity. Nor is it known if any of these Marquette County ponds still produce *R. mutata*, so future surveys of these ponds would be helpful.

A cluster of sites having *R. mutata* has since been found to the southeast of Marquette County, mostly in Waukesha County. On 21 May 2009, while conducting biotic inventories for the Natural Heritage Inventory (DNR), Kurt Schmude collected two F-0 nymphs of *R. mutata* from each of two ponds, one north of LaGrange in Walworth County and one near Eagle in Waukesha County, both in the Kettle Moraine State Forest, Southern Unit (KMSF-SU). Other Waukesha County records include the following: on 11 June 2010, Bill observed mating and ovipositing behavior at the pond near Eagle. On 2 June 2010, Richard Staffen photographed a male flying at a small pond near Ottawa. On 8 June 2013, Bill collected two exuviae at an unnamed pond in the KMSF, Lapham Peak Unit; this pond had spatterdock in the open, central area, but it was *Nuphar variegatum*, not the emergent *N. advena*. On 18 June 2013, Paul Sparks photographed a male near Henrietta Lake. Thus, the current distribution of *R. mutata* in Wisconsin appears to be centered in or near the KMSF-SU, in west-central and southwestern Waukesha County.

There is little doubt that *R. mutata* is not secure in Wisconsin and well deserving of its state Threatened status and S1 state ranking (Critically imperiled in Wisconsin because of extreme rarity; Natural Heritage Working list of the DNR). The change in habitat conditions where *R. mutata* was first documented at Stoick's Pond is a shocking reminder of the fragility of the shallow, often small ponds required by this species.

Conclusion

Because of many recent records, an extensive area with a longitudinal width of about 250 km, from eastern Minnesota through south-central Wisconsin, is now known to contain overlapping ranges of *R. multicolor* and *R. mutata* (Figure 1). At the eastern edge of its range in Wisconsin, *R. multicolor* is found in small, mucky, cattail-rimmed ponds and shallow lake bays having few or no fish in partly open landscapes. At the western edge of its range in both

states, *R. mutata* is known from shallow ponds lacking centrarchid fishes. These ponds are variable in surface area, but have extensive coverings of spatterdock, and are found in mostly forested landscapes.

Although the preferred habitats of the two species differ markedly in several ways, both species can fly considerable distances from their breeding habitats and either could be observed at a variety of waterbodies and uplands within the area of overlap. Species of *Rhionaeschna* are relatively easy to recognize even in flight as being in that genus because of their bright blue eyes (Figure 3), but care must be used to distinguish the two Midwestern species. Odonatists in these states who survey in or near the area of overlap should not assume the species identity of a darner with blue eyes based on habitat characteristics or geographic location alone; rather, identification characters for separating these two species in the field, in the hand, and in photographs should be used. Known breeding habitats of *R. mutata* in the Upper Midwest are fragile and deserving of the highest levels of protection. When groundwater is drawn for residential, commercial and agricultural uses, as is occurring in Waukesha County, shallow aquatic systems can be put at risk. We urge odonatists to conduct surveys at suitable habitats for both species in both states, and to report their findings to OdonataCentral <http://www.odonatacentral.org/>, to Ron directly for Minnesota records, and to the Wisconsin Odonata Survey (WOS; <http://wiatri.net/inventory/odonata/>) for Wisconsin records.

Figure 3. Blue-eyed Darner (*Rhionaeschna multicolor*) in flight in LaCrosse County, Wisconsin. Photo by Dan Jackson.

Acknowledgments

Bob and Bill were funded by the DNR, NHC, and biotic inventories done by K. Schmude were initiated and funded by the Natural Heritage Inventory (DNR, NHC). We thank C. Chrouser, J. Fischer, D. Hanson, R. Johnson, K. Kim, S. King, K. Mead, J. Pleski, K. Schmude, E. Spalding, P. Sparks, R. Staffen, K. Tennessen and T. Vogt for assistance in the field or for supplying records to WOS or to OC. We also thank Molly Wick for constructing the map.

Atlas of the European Dragonflies and Damselflies Due to Appear

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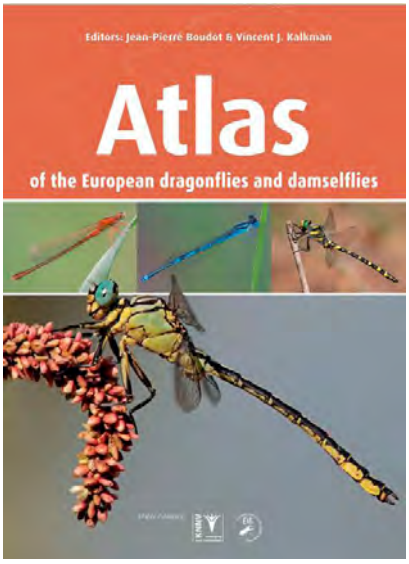
During the past decade, more than 50 European odonatologists have been co-operating to bring together all published and unpublished distribution records of the 143 European species of dragonflies and damselflies. The results of this endeavor will appear in December 2015 as: Boudot, J.P. & V.J. Kalkman (eds.) 2015. Atlas of the dragonflies and damselflies of Europe. KNNV-uitgeverij, Netherlands.

The book includes over 200 distribution maps showing both the European and global distributions of species. Further information includes taxonomy, range, population trends, flight season, habitat, photos of nearly all species, and an overview of the history of odonatological studies in each country. The book can be pre-ordered for the reduced price of 60 euros by sending an e-mail to <info@knnvuitgeverij.nl> with the sublect line 'Special Offer Price Atlas of the dragonflies and damselflies of Europe'. Don't forget to mention your name. You will be contacted when the book is available so you can order it directly via our web site. More information on the book, including a preview, can be found at <http://www.knnvuitgeverij.nl/EN>.



The Ménard Aquatic Net for Collecting Dragonfly Larvae

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For over 25 years, the authors have been using our own aquatic net for collecting dragonfly larvae, invented by BM. It basically consists of an angler's net for retrieving hooked fish, bought at a hardware store and adapted for collecting odonate larvae. The original fishing net is first removed from the rim and replaced with metallic, aluminum, or even mosquito screening, solidly tied or affixed to the rim with wiring. The original handle, stick and rim are thus retained, only the fish netting is discarded. In the province of Québec , these fish nets are currently sold for about $40 dollars. This new type of aquatic net collects little debris, mud, or sand, since it has no depth for accumulation of material we don't need, and enables the user to spot captured larvae immediately.

During our field trips, we adapt the use of this aquatic net according to the types of larvae we hope to collect. To net species that swim freely in the water column, such as the genera *Aeshna* and *Anax* (darners), *Leucorrhinia* (whitefaces), *Sympetrum* (meadowhawks) and the zygopterids (damselflies), the user moves the net not too far from the water surface, and explores the underwater stems on which these types of larvae tend to perch. The odonatist should do the utmost to prevent damage or breakage of these stems when foraging for these larvae.

When searching for dragonfly nymphs which crawl or walk on muddy or silty bottoms, one must skim the substrate with the net without applying too much weight or strength. Dragonfly larvae of the following genera should appear in the net: *Libellula* (skimmers), *Cordulia* and *Somatochlora* (emeralds), and others.

This type of net may be also used to dig in muddy or sandy substrates to dislodge larvae of genera such as gomphids (clubtails) and cordulegastrids (spiketails). However, this method may damage the net or tear the bottom screen, the most solid type being of course metallic screen. According to the different uses of such aquatic nets, the user may be forced to repair the screen or broken stick annually or perhaps more often.

Ménard aquatic nets (may be made in different sizes).

Anax (darner) larvae (swimmers) with budding small wingpads (upper) and long wingpads (lower).

Finally, it is also possible to use this net in the running water of streams with small stones. The gear is placed in the current of moderately slow or fast moving water using the "kicking" method, in which the net opening is placed facing the current and the user kicks the small stones into the net, hoping to find and dislodge dragonfly nymphs among the stones. This method is the most damaging for this type of net and frequent repairs become the order of the day. There are better ways of securing larvae such as *Ophiogomphus* (snaketails), for instance. As a side note, ophiogomphid nymphs exist in very large numbers in many of these Québec types of streams, while adult individuals remain very difficult to observe in nature, their whereabouts still shrouded in mystery.

Advantages of the Ménard aquatic net

The adoption of Ménard's type of aquatic net has many advantages. Its correct uses cause very little damage to the microhabitats, as the structure of mud, debris and decomposing vegetation at the bottom of the bodies of water explored remain minimally modified or perturbed. The small amount of material scooped and present in the net makes its handling lighter for the user. Most important, the odonatist sees the larvae collected almost instantly and can assign many individuals to genera by some behavioral traits in the net. The swimming type of larvae, such as *Aeshna*, *Leucorrhinia*, *Sympetrum,* and *Libellula* are usually very active in the net, although *Aeshna* larvae may play dead, especially when manipulated. Larvae of *Somatochlora*, *Williamsonia* (boghaunters), *Nannothemis* (Elfin Skimmer) and perhaps others move very little in the net, thus being often overlooked. The habitus and movements of many gomphids in the net are easily recognized in many instances with practice.

Perhaps the most important for the user of our net is to acquire the habit of observing the length of larval wingpads to collect only or mostly individuals that are mature or close to maturity. Collecting very young larvae without wingpads or with only budding or small wingpads should be avoided, since correct identification of such specimens is most difficult, often very risky and even impossible in many cases. Young larvae that appear in the net should be released and returned to water. The eye of the collector becomes adept to recognize small larvae with long wingpads (*Leucorrhinia*, *Sympetrum*) and large larvae (*Aeshna*, *Anax*) with budding or short wingpads. This being said, it is true that young larvae of a number of species become recognizable with practice and careful examination, but

Gomphus (clubtail) larva, a burrower.

Sympetrum (meadowhawk) larvae (swimmers), with small (left) small and long (right) wingpads.

Cordulia (spiketail) larva, a bottom-walker.

are best left to grow to maturity in their natural environment.

Through this article, we hope that more dragonfly enthusiasts will realize the importance and fascination of dragonfly larval studies. The larval stage is, after all is said and done, an extremely important part of the total life of a dragonfly.

Odonata in the News

Odonata in the News is compiled by the Editor. Please feel free to send me alerts about any noteworthy odonate-related items including news stories, popular articles, and scientific publications at <cmazzacano@gmail.com>. A sampling of recent newsworthy Odonata includes:

Carvalho, A. 2014. Rock and roll dragonfly: a preliminary study on the symbolism of dragonflies (Odonata) in the lyrics of Western contemporary songs. Entomologia Cultural: Ecos do I Simposio Brasiliero de Entomologia Cultural 2013. In this delightful study, the author examined the lyrics of 100 English-language rock songs recorded within the last few decades whose titles or lyrics contain some form of the word dragonfly, from the artist A-ha's song Dragonfly on the album Lifelines to Ziggy Marley's Dragonfly song from the album of the same title. Changes in distribution of in the number of such albums and songs from 1970–2013 is examined, the level of biological accuracy among the lyrics is contrasted (my favorite is "dancing sweet dragonfly, live your life in a day", a mental hybrid of ode with mayfly). Differences in symbolism are also assessed; not surprisingly for the genre, perhaps, the Devil and drugs get their fair share, although odes are also made to embody the memory of youth and summer love. This was altogether a delightful read; many thanks to Dennis Paulson for bringing it to my attention.

Pfitzner W.F., M. Beck, T. Weitzel, and N. Becker. 2015. The Role of Mosquitoes in the Diet of Adult Dragon and Damselflies (Odonata). Journal of the American Mosquito Control Association 31(2): 187–189. The flood plains of the Upper Rhine Valley provide excellent conditions for the proliferation of mosquitoes as well as for the development of dragon and damselflies. It could be assumed that mosquitoes belong to the diet of the Odonata and that the latter could be harmed by the reduction of the mosquito population with the purpose of diminishing the massive nuisance for the people living there. A total of 41 adult dragonflies and damselflies were examined by immunoblot for remnants of mosquitoes in their guts. A rabbit antiserum against *Aedes vexans* proteins was used for the immunoblot. Only three *Aeshna cyanea* and one *Platycnemis pennipes* could be shown to have fed on mosquitoes. In specimens of the genus *Sympetrum* no mosquitoes were detected. The authors conclude it doubtful that mosquitoes are an essential part of the Odonata diet.

Xu, M. & O.M. Fincke. 2015. Ultraviolet wing signal affects territorial contest outcome in a sexually dimorphic damselfly. Animal Behaviour 101: 67–74. A study on damselflies has shown that ultraviolet ornamentation improves their competitive success. Males of the *Megalo-prepus caerulatus,* the Helicopter Damselfly, defend water-filled tree holes where females mate and lay their eggs. Working on Barro Colorado Island, Panama, researchers carried out behavioural field trials in which they released a male damselfly into the territory of another male while the resident male was away foraging, and then observed the contest that occurred when the resident returned. The wings of male *M. caerulatus* have a white band that reflects strongly in the ultraviolet wavelength. Before release, some introduced males were treated by painting their wing bands with sunscreen to reduce their UV reflectance. Early in the reproductive season, when the value of breeding sites was greatest, all staged contests were won by unpainted males, but this bias disappeared as the season progressed. This is the first evidence that invertebrates can use ultraviolet markings to settle disputes. A few vertebrates are known to have similar abilities. Because the area of the white wing band increases disproportionately with damselfly body size, the signal may make it easier for males to assess the size of their opponents.

Hassall C., T.N. Sherratt, P.C. Watts and D.J. Thompson. 2015. Live fast, die old: no evidence of reproductive senescence or costs of mating in a damselfly (Odonata: Zygoptera). Journal of Animal Ecology doi: 10.1111/1365-2656.12407. An assumption about insect populations is that because their life span is so short, they are not affected by senescence. This study examined age-related patterns in breeding (reproductive senescence) and breeding-related patterns in mortality (costs of mating) in natural populations of the damselfly *Coenagrion puella* (Azure Bluet) in southern England. Average copulation time for this species is 28 minutes, and males engage in contact-guarding of females during oviposition for about 84 minutes. Data from mark-recapture studies done across two breeding seasons and presence of marked individuals at the mating rendezvous site or engaged in mating was scored. The presence of actuarial senescence (age-related increase in mortality) was confirmed, but there was little evidence of reproductive senescence (increase in mortliaty related to reproductive activities); rather, higher survival was seen in males that mated with greater frequency. This suggests individuals that breed successfully may be of better individual quality and thus more likely to survive and continue breeding.

Corser, J.D., E.L. White, and M.D. Schlesinger. 2015. Adult activity and temperature preference drives region-wide damselfly (Zygoptera) distributions under a warming climate. Biology Letters doi: 10.1098/rsbl.2015.0001. We analysed a recently completed statewide odonate Atlas using multivariate linear models. Within a phyloge-

netically explicit framework, we developed a suite of data-derived traits to assess the mechanistic distributional drivers of 59 species of damselflies in New York State (NYS). We found that length of the flight season (adult breeding activity period) mediated by thermal preference drives regional distributions at broad (105 km^2) scales. Species that had longer adult flight periods, in conjunction with longer growing seasons, had significantly wider distributions. These intrinsic traits shape species' responses to changing climates and the mechanisms behind such range shifts are fitness-based metapopulation processes that adjust phenology to the prevailing habitat and climate regime through a photoperiod filter.

Lambret P., A. Besnard, and N. Matushkina. 2015. Plant preference during oviposition in the endangered dragonfly *Lestes macrostigma* (Odonata: Zygoptera) and consequences for its conservation. Journal of Insect Conservation 19(4): 741–752. Biotic and abiotic features impact the breeding success of animals and thereby induce selection pressures for habitat selection. Little is known about the plant selection by predatory insects which lay their eggs within plants. In previous work, we have highlighted that during oviposition males of *Lestes macrostigma*, an endangered dragonfly species, prefer to land on *Bolboschoenus maritimus* and dead shoots of *Juncus maritimus* but disfavour living shoots in that species, and that females seem to prefer dead material during substrate examination. In this study we assessed behavioural preference in females during substrate examination, substrates suitability for oviposition, the effort females had to make to lay their eggs and their resulting oviposition rate. We show *L. macrostigma* has a preference for *B. maritimus* and, albeit to a lesser extent, for dead substrates. No clear trend appeared regarding substrate suitability. Females had to make a greater effort to lay an egg within living shoots of *J. maritimus*. By contrast, this effort was less in *B. maritimus* and dead shoots of *J. maritimus* and the oviposition rates were higher for these two types of substrate. We hypothesize that these preferences are relevant in the selection of oviposition substrates which are more likely to be flooded earlier by rainfall, reducing risk of egg desiccation and increasing hatching success. With regard to conservation, *B. maritimus* and *J. maritimus* should be encouraged by wildlife managers especially in habitat restoration programs which aim to increase the number of suitable breeding sites for the species.

Special Issue: Directions in Applied Odonatology: Freshwater Science September 2015. The publications that follow are all part of a special issue resulting from presentations at the 2013 Society for Freshwater Science Annual Meeting Odonata Sympsium organized by Jason Bried:

1. Bried J.T., C. Hassall, J.P. Simaika, J.D. Corser, and J. Ware 2015. Directions in dragonfly applied ecology and conservation science. Freshwater Science 34(3): 1020–1022. This series emerged from a symposium at the 2013 annual meeting of the Society for Freshwater Science in Jacksonville, Florida. Presenters highlighted some of the current directions in dragonfly conservation science and recent advances linking odonatology to freshwater applications and conservation. The symposium and series integrate diverse topics, perspectives, and geographic representation along with experience levels ranging from graduate students to post docs to some of the most prolific researchers in odonatology. The goal was to showcase odonates for their utility and as worthy subjects of study.

2. Bried, J.T. and M.J. Samways. 2015. A review of odonatology in freshwater applied ecology and conservation science. Freshwater Science 34(3): 1023–1031. The academic study of dragonflies and damselflies (odonatology) is well established, but relatively limited attention has been given to odonates in the context of applied ecology and conservation science. Web of Science™ and Odonatological Abstract Service was used to capture trends in primary literature, characterize study features, identify research themes, and suggest future directions for odonatology in freshwater applied ecology and conservation science. There were no papers in this area prior to 1980, and 411 papers from 1980 through 2013. Nearly 75% of these were recent (since 2005) and >40% were very recent (since 2010). Several broad and overlapping research themes were seen: 1) model taxa, 2) tools and indicators, 3) odonate-centered work, and 4) methodological issues and improvements. There was more reliance on field-based observational approaches than experiments and model-driven exercises, although the number of papers using model-driven exercises is rapidly increasing. A strong focus on adult stages, odonate assemblages, Odonata as a whole, and studies of particular species was seen. Research priorities were identified in ecological valuation and management, monitoring and assessment, climate change and landscape planning, concordance with other taxa, effects of urbanization, data modeling/simulation, and rare species ecology and conservation. To help establish an identity and facilitate communication, the authors suggest naming this diverse realm "applied odonatology". Applied odonatology has a good future for a range of topics from conservation genetics and population ecology to assessments of anthropogenic impacts and the conservation of biodiversity.

3. Stoks R., S. Debecker, K.D. Van, and L. Janssens. 2015. Integrating ecology and evolution in aquatic toxicology: insights from damselflies. Freshwater Science 34(3): 1032–1039. Current legislation and ecological risk

assessment fails to protect aquatic biodiversity at low levels of contaminants. We addressed 3 topics embedded in general stress ecology and evolutionary ecology that are relevant to arrive at a better evaluation of the risk of low contaminant levels in aquatic systems: 1) delayed effects of contaminants, 2) interactions between contaminants and biotic interactors, and 3) vulnerability to contaminants under global warming. We developed these topics by capitalizing on the key insights obtained using damselflies as model organisms. First, delayed contaminant effects on important fitness-related effects exist during the larval stage and after metamorphosis in the adult stage. Second, synergistic interactions of contaminants with bacteria and predation risk have been demonstrated, and we present advances in the mechanistic understanding of these synergisms with biotic interactors. Third, we illustrate the strength of assessing the effect of contaminants under global warming using a space-for-time substitution approach and the need to consider temperature extremes. These studies using damselflies as model organisms highlight the relevance of considering contaminant effects after the exposure period and in the presence of natural stressors, such as predation risk and higher temperatures. They further highlight the need for spatially explicit risk-assessment and conservation tools. These insights are relevant for most aquatic taxa, which have a complex life cycle, are strongly affected by predation risk and by warming, and show latitudinal gradients. Better integration of these topics in ecological risk assessment will be a major challenge for both scientists and policy makers, but of crucial importance to preserve aquatic biodiversity.

4. Hassall, C. 2015. Odonata as candidate macroecological barometers for global climate change. Freshwater Science 34(3): 1040–1049. Many investigators have described a footprint of global environmental change in macroecological trends across multiple taxa. However, little comparative analysis has been done to evaluate whether some taxa are responding more than others. I tested 2 hypotheses: 1) taxa vary strongly in terms of range shifts and phenological advances in their responses to changing climate, and 2) taxa that shift ranges also advance phenology. I used an initial database of >4 million recorded sightings of UK animal species from 24 orders and found descriptions of range shifts for 612 species and phenological trends for 923 species. I compared the 2 responses for 464 species and found wide variation in the extent to which taxa are responding. Vertebrate taxa were the least well recorded and showed weak or nonsignificant responses. Invertebrates were well recorded and responded strongly in range and phenology, but evidence of an association between range shifts and phenological advances was equivocal. My results show that different taxa are exhibiting different responses to the same environmental change, and that mechanistic and traits-based studies may reveal the causes of that variation. Spatial responses may be constrained by mode of dispersal, and insects and arachnids typically respond strongly, whereas terrestrial vertebrates do not. Phenological responses are complex and may involve species-specific physiological relationships between development and seasonal cues. Use of a model taxon could increase efficiency of monitoring regimes by simplifying monitoring targets and techniques. Potential exists for ≥1 taxa to be indicators of climate change, whereby the responses of one or a group of species could be used to infer changes at a broader taxonomic scale. I highlight Odonata as a taxon that responds strongly in multiple modalities, is charismatic enough to appeal to citizen scientists, and is an emerging physiological and genetic model.

5. Harabiš F. and A. Dolný. 2015. Odonates need natural disturbances: how human-induced dynamics affect the diversity of dragonfly assemblages. Freshwater Science 34(3): 1050–1057. The still-growing effect of human activities on aquatic habitats has led to proportionately increasing need for restoration activities. Paradoxically, restoration actions can constitute a major threat to freshwater assemblages if they do not respect the specific nature of the target biotopes. We investigated the dynamics of dragonfly assemblages in 20 mine-subsidence pools (habitats with very high and very unpredictable dynamics). We used multivariate methods and diversity indices to compare species richness and species composition of assemblages before and after reclamation actions. During the 10 y of the study, we recorded 10 cases in which aquatic habitats disappeared completely and 6 cases of recovery and successful recolonization of aquatic pools. Disturbances caused by reclamation actions led to significant reduction of diversity and to extirpation of sensitive dragonfly species. Moreover, unlike natural disturbances, disturbances caused by reclamation activity do not support the occurrence of species associated with early successional stages. Major interventions in freshwater habitats can cause alterations that often paradoxically may result in local extinction of sensitive species rather than strengthening of existing populations.

6. Monroe, E.M. and H.B. Britten. 2015. Single-sample estimation of effective population size in several populations of the endangered Hine's Emerald dragonfly. Freshwater Science 34(3): 1058–1064). Hine's Emerald (*Somatochlora hineana*) is the only dragonfly on the US Endangered Species list. It prefers discrete fen and wet-meadow habitat from Ontario, Canada, to Missouri, USA. This habitat has been destroyed across much of *S. hineana*'s range. Its conservation genetics were assessed by microsatellite analysis in a previous study. We applied 2

common single-sample estimators to the same data set to estimate effective population size (Ne), or effective number of breeders, in 5 populations (separated into adult and naiad stage classes) across the species' range in 2008 and 2010–2011. Populations of the species in the Upper Peninsula of Michigan, the Door Peninsula of Wisconsin, and along the Des Plaines River Valley in Illinois are made up of individuals collected from multiple sites, but the other 2 populations, at Cedarburg Bog, Wisconsin, and along the Lower Wisconsin River, consist of samples from single habitats disjunct from other known sites. Ne for *S. hineana* were similar to those for other endangered insects and ranged from 22 adults in the Des Plaines River Valley population in 2010 to 200 adults in the Door Peninsula population in 2010 based on approximate Bayesian estimation in ONeSAMP and from 8 naiads in the Door Peninsula population to 419 adults in the Des Plaines River Valley population based on the linkage disequilibrium method in NeEstimator. These Ne values confirm the endangered status of this species and indicate that efforts to maintain current habitats and connectivity to suitable habitat are essential to maintaining genetic diversity.

7. Olalla Lorenzo-Carballa M., S. Ferreira, A.M. Sims, D.J. Thompson, P.C. Watts, Y. Cher, V. Damoy, A. Evrard, W. Gelez, and C. Vanappelghem. 2015. Impact of landscape on spatial genetic structure and diversity of *Coenagrion mercuriale* (Zygoptera:Coenagrionidae) in northern France. Freshwater Science 34(3): 1065–1078. Loss and fragmentation of habitat is a current main cause of biodiversity loss in freshwater habitats. Odonates depend on these habitats to complete their development. Fragmentation may be a particular threat for odonates because it generates a network of small habitat patches within which populations could suffer from isolation and loss of genetic diversity. The southern damselfly *Coenagrion mercuriale* is categorized on the IUCN red list as Near Threatened, largely because of population fragmentation and demographic declines associated with changes in land use. Small populations at the margin of this species' range are of particular concern because they would be prone to detrimental effects of habitat fragmentation if this species were a poor disperser. We sampled *C. mercuriale* in 16 habitat patches (localities) at 4 main sites in the department of Pas-de-Calais in northwestern France to quantify factors that affect dispersal and genetic diversity. Specimens were genotyped at 12 microsatellite loci to quantify genetic diversity, genetic differentiation, and the potential effect of landscape variables on genetic differentiation, and to detect any potential source–sink structure. Habitat separation had a limiting effect on dispersal by *C. mercuriale*, resulting in 3 main genetic clusters and weak divergence at the main site of Vallée de la Course. Genetic differentiation was low in each main site, implying that the localities within sites were connected at scales of up to ~2 km, albeit with some evidence for isolation at the more isolated localities. Given the degree of isolation of some areas and a lack of apparent genetic mixing in the intervening populations, any movement among the most distantly separated sites must have occurred some time ago. We identified barriers to dispersal, such as woodland, but detecting an unambiguous effect of certain variables, such as urbanization, was difficult because many landscape features were highly correlated.

8. White, E.L. P.D. Hunt, M.D. Schlesinger, J.D. Corser, and P.G. deMaynadier. 2015. Prioritizing Odonata for conservation action in the northeastern USA. Freshwater Science 34(3): 1079–1093. Odonata are valuable biological indicators of freshwater ecosystem integrity and climate change, and the northeastern USA (Virginia to Maine) is a hotspot of odonate diversity and a region of historical and growing threats to freshwater ecosystems. This duality highlights the urgency of developing a comprehensive conservation assessment of the region's 228 resident odonate species. We offer a prioritization framework modified from NatureServe's method for assessing conservation status ranks by assigning a single regional vulnerability metric (R-rank) reflecting each species' degree of relative extinction risk in the northeastern USA. We calculated the R-rank based on 3 rarity factors (range extent, area of occupancy, and habitat specificity), 1 threat factor (vulnerability of occupied habitats), and 1 trend factor (relative change in range size). We combine this R-rank with the degree of endemicity (% of the species' USA and Canadian range that falls within the region) as a proxy for regional responsibility, thereby deriving a list of species of combined vulnerability and regional management responsibility. Overall, 18% of the region's odonate fauna is imperiled (R1 and R2), and peatlands, low-gradient streams and seeps, high-gradient headwaters, and larger rivers that harbor a disproportionate number of these species should be considered as priority habitat types for conservation. We anticipate that our analysis might serve as a model for guiding and standardizing conservation assessments at multiple scales for Odonata and other diverse taxa that have not yet received attention to prioritization.

9. Termaat, T., R.H.A. van Grunsven, C.L. Plate, and A.J. van Strien. 2015. Strong recovery of dragonflies in recent decades in The Netherlands. Freshwater Science 34(3): 1094–1104. Many dragonfly species in The Netherlands declined in the 20th century because of acidification, eutrophication, and desiccation of lotic and lentic habitats and canalization of streams and rivers. These pressures peaked in the 1970s, when 26 of 65 native species had an unfavorable conservation status on the 1997 Dutch Red List. Since the 1980s, environmental regulations have

led to improved water quality, and many habitat restoration projects have been carried out. We used standardized monitoring data (1999–2013) and unstandardized observations (1991–2013) to investigate how dragonflies have changed in the last 20 yr on a national scale. We compared trends of dragonfly species from different habitat types and with southern vs. northern distribution in Europe. Dragonflies recovered strongly in The Netherlands in a period of ~20 yr, probably because of recent habitat improvements. Lotic species have benefitted more than lentic species, and southern species have more positive trends than northern species, suggesting that climate change has contributed to the recovery. Dragonflies were resilient and able to quickly recover when their habitats were restored. Recovery has led to a better conservation status for many species. Unstandardized data delivered results consistent with those from monitoring data and had greater statistical power to detect trends because many more unstandardized data than standardized data were available. Thus, when the goal is to provide a general overview of changes in dragonflies, unstandardized data can outperform standardized abundance data. However, abundance data may deliver complementary information for individual species. Our results support the suitability of dragonflies as indicators of freshwater habitat condition, but they recover more strongly in The Netherlands than many other insects, possibly because of their higher dispersal abilities or different habitat requirements.

10. Bried, J.T., A.M. Dillon, B.J. Hager, M.A. Patten, and B. Luttbeg. 2015. Criteria to infer local species residency in standardized adult dragonfly surveys. Freshwater Science 34(3): 1105–1113. For dragonflies, the final exuviae are the most identifiable nymphal stage, can substitute for lethal processing of live animals, and definitively indicate life-cycle completion or reproductive success. However, dragonfly exuviae are difficult to find and identify relative to adults, and species richness in exuvial surveys is generally biased low. We tested readily acquired information in adult surveys as indicators of exuviae presence and, therefore, species residency. Repeated concurrent surveys of adults and exuviae were completed at 32 wetlands in New York and 30 wetlands in Oklahoma, USA. We modeled the occurrence of exuviae as logit-linear functions of adult abundance, detection frequency (across surveys), teneral frequency, and frequency of breeding behavior while controlling for imperfect detectability. Exuviae occupancy probabilities suggested several reliable indicators of species residency: 1) finding adults on ≥4 surveys, 2) finding tenerals on ≥2 surveys, and 3) counting >20 adults on ≥1 surveys (with caveats). The odds of exuviae occurrence when these conditions were met were ~9 to 18× greater than when no adults were detected. Species residency may be accurately inferred during adult surveys, potentially improving freshwater applications and conservation via dragonflies.

11. Patten, M.A., J.T. Bried, and B.D. Smith-Patten. 2015. Survey data matter: predicted niche of adult vs. breeding Odonata. Freshwater Science 34(3): 1114–1122. Assessing and categorizing habitat needs or population trends of organisms with complex life histories, such as Odonata, is challenging. All Odonata have aquatic nymphs and terrestrial adults. As a consequence, their use as indicators of ecosystem health or as umbrella species in conservation plans may be misleading if data from a particular life stage does not reflect actual residency at a freshwater site. We explored this question with an extensive data set for Odonata from Oklahoma, USA, to determine if ecological niches modeled from records of adults (i.e., lacking any evidence of breeding) differed from niches modeled for records indicating breeding (tandem pairs, ovipositing females, larvae, teneral [recently emerged adults], or exuviae [shed exoskeletons of larvae]) at surveyed sites. We predicted that models would be comparable if adult presence strongly indicates local breeding but would be dissimilar if adults occupy many more sites than those at which the species breeds. Our results supported the latter prediction. Adult models were broader geographically and had a wider, more equitable (higher evenness) balance of contributing environmental variables (niche dimensions) than did models for breeders, which tended to be more ecologically specialized. These findings suggest that surveys of adult Odonata, which are relatively easy to obtain because of organized efforts to encourage observations by citizen scientists, can paint a misleadingly broad picture of a species' ecological niche. We recommend that evidence of breeding, especially presence of tenerals or exuviae, be used to outline ecological requirements when questions of conservation or population monitoring arise.

12. De Marco Júnior, P., C. Corrêa Nóbrega, R.A. de Souza, and U.G. Neiss. 2015. Modeling the distribution of a rare Amazonian odonate in relation to future deforestation. Freshwater Science 34(3): 1123–1132. The advance of the deforestation frontier in the Amazon forest, the largest tropical forest and one of the richest ecosystems in the world, has threatened several plant and animal species. A lack of good biogeographical information of their distributions and a shortage of basic knowledge on their ecology hinder the proper evaluation of the vulnerability of those species. We used species distribution modeling techniques to fill these gaps and to estimate the vulnerability of a forest-dwelling odo-

nate endemic from the Amazon, *Diastatops nigra*. We used the MaxEnt algorithm and compared the efficiency of this method in relation to the type of environmental data set (climate-only and climate+hydrographic environmental variables). We also estimated the decrease in extension of occurrence of *D. nigra* in relation to a recently developed model for future deforestation also produced with the MaxEnt approach. Predicted suitable areas were isolated patches in the central Amazon and many peripheral areas. In general, those areas had stable climates with low seasonality in rainfall. The Amazon deforestation frontier is expanding mainly from the south. The core area of *D. nigra* distribution is in the central Amazon, so in the short-term projection, the main threat for this species was not the deforestation itself. However, deforestation may extirpate some peripheral populations of this species and increase isolation among those patches of suitable areas. We suggest the use of this model for prioritizing future odonate inventories targeting the other species of the group.

13. Simaika, J.P. and M.J. Samways. 2015. Predicted range shifts of dragonflies over a wide elevation gradient in the southern hemisphere. Freshwater Science 34(3): 1133–1143. Human-induced climate change is among the greatest threats to biodiversity, especially when coupled with habitat destruction. For an already water-stressed country like South Africa, changes in temperature and precipitation regimes, coupled with increasing water demands, are likely to lead to losses in biodiversity. Dragonflies are a well-studied surrogate taxon for aspects of freshwater biodiversity. We created species distribution models for 14 dragonfly species, and predicted the changes in species richness, extent of occurrence, and habitat suitability for the years 2050 and 2080 in South Africa, a poorly studied area for range-change predictions for insects. Model predictions for 2 different emissions scenarios suggest that at least 2 species will be lost from the area by 2050, and 3 by 2080. All are widespread Afrotropical species, but with narrow elevation ranges in South Africa. Only 1 species is predicted to benefit greatly from climate change. The remaining species are predicted to persist with reduced extents of occurrences at higher elevations. Most species we studied (12 of 14) thrive in artificial environments. Therefore, to a certain extent, loss in connectivity is unlikely to play a role for these species. However, the 2 stream specialists that occur in the area are particularly vulnerable because of loss of habitat. Species that currently occur farther north in southern Africa and South Africa also are likely to move southward in the future. Thus, species richness may not necessarily decrease, but replacement of species within communities will be significant.

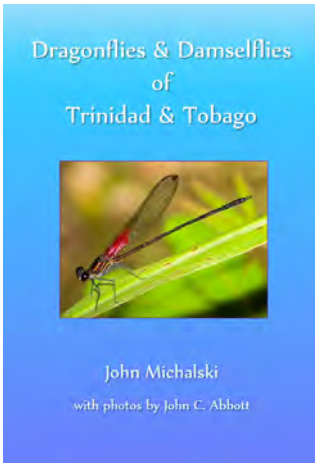
14. Collins, S.D. and N.E. McIntyre. 2015. Modeling the distribution of odonates: a review. Freshwater Science 34(3): 1144–1158. Species distribution models (SDMs) can be used to answer a variety of questions about Odonata (dragonflies and damselflies) distributions because locality data for species are readily available. We provide an overview of SDMs and review 30 studies that have used SDMs to examine factors governing odonate distributions in current and projected future scenarios. These studies had objectives that included predicting the potential geographical distribution of a species based on scattered records, quantifying hotspots for biodiversity and identifying reserve gaps, assessing species' environmental requirements and limitations, quantifying dispersal abilities of species with different life histories, studying niche conservatism among sympatric species, modeling the effect of forecasted climate change on species distributions, and examining the efficacy of different modeling approaches. We point out limitations in the use of SDMs for these purposes, including effects of limited taxonomic coverage and limited spatial resolution at fine scales. We also highlight potential future areas where use of SDMs can advance our knowledge of odonate–environment interactions.

New Book Announcement: The Dragonflies and Damselflies of Trinidad & Tobago, by John Michalski, With Photos by John C. Abbott

The Dragonflies & Damselflies of Trinidad & Tobago, by John Michalski, with photos by John C. Abbott. Published September 2015 by Kanduanum Books, Morristown New Jersey, 270 pp. in full color. Photos, illustrations and keys for all 121 species. Soft cover. Book dimensions: 4.5 x 7.25 x 0.50 inches. $25.00 plus shipping & handling. ISBN: 978-0-9887198-2-8. Pre-order directly from the author at <huonia@aol.com>.

Description: Located at the extreme southern tip of the Lesser Antilles, Trinidad and Tobago's biological affinities are with the South American mainland, rather than the Caribbean islands to the north.

Together, these two islands are home to over 120 species of dragonflies and damselflies—all covered in this field guide—and provide a perfect introduction to the flora and fauna of the Neotropics.



First Announcement—2016 DSA SE Regional Meeting

Bill Mauffray, International Odonata Research Institute <iodonata@gmail.com>

The 2016 SE DSA gathering will be in spring of 2016 (tentative dates 1–3 April 2016). The base of operations will be the Super-8 hotel off of I-49 just north of Alexandria, Louisiana near the Alexandria International Airport. This location provides easy access to the Kisatchie National Forest. Bill Mauffray and Steve Shively will be co-hosting the gathering. Target species include regional endemics such as *Cordulegaster sarracenia* (Sarracenia Spiketail) and *Gomphus oklahomensis* (Oklahoma Clubtail). We will be on the lookout on some of the sandy/gravely streams for any *Ophiogomphus*, even though none have been reported from west of the Mississippi within the state. More about this in the next issue. If you are potentially interested please e-mail Bill at <iodonata@gmail.com> to be included in the preliminary e-mail group.

How I Fell Into the Clutches of the Odonata

This feature presents essays from DSA members describing how, when, where, and why they first became interested in Odonata. It also doubles as 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 <cmazzacano@gmail.com>. Accompanying pictures to illustrate the tale are also encouraged. Whether you just discovered odonates this spring or have pursued them for decades, I know there are plenty of interesting, entertaining, and inspiring stories out there to be told!

Parting Shots

Parting Shots pays tribute to the endless diversity and interest of odonate behaviors and to the many 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 an odd, bizarre, unusual, unexpected, or amusing aspect of odonate life (or of life with odonates), please e-mail them to the Editor at <cmazzacano@gmail.com>, along with a short note describing the photo, location, and event.

Charging Ahead

Dan Jackson <DanJackson@lbwhite.com>

On 23 July 2015, Dan took a series of shots of a mating pair of Skimming Bluets (*Enallagma geminatum*). When he first started shooting, he noticed they were not locked together yet and that the male seemed to be trying to position the female. When he checked his photos, he realized that he had captured this series of images at the right-hand column, clearly showing the male doing a sperm packet transfer before coupling (the sperm packet can be seen in the 2nd photo in this series).

A Sign of Odes to Come

Celeste Searles Mazzacano <cmazzacano@gmail.com>

Most participants in the DSA Regional Meeting in Costa spent the afternoon of 31 May 2015 wandering the gardens on the grounds of the Hotel Bougainvillea, eager to get our first glimpses of the cornucopia of tropical biodiversity that awaited us throughout the coming week. Bird sightings were plentiful, but not too many odonates were spotted. That evening, Dennis Paulson gave a presentation on the Odonata of Costa Rica that whetted our appetites even further. As we exited the small outbuilding where the presentation had taken place, this previously unnoticed stained glass window in the main hotel building shone like a beacon of colorful odes to come—my first dragonfly sighting in Costa Rica! (photo on following page)

Male Skimming Bluet (*Enallagma geminatum*) charging his penis while holding the female.

Odes of a Feather...Observation at the DSA Annual Meeting

Tony "Doc" Schoch <arssls@ptd.net>

After leading a survey group at the meeting in State College, Pennsylvania, I headed for the Saturday night picnic at Whipples Dam State Park. As I cruised into the parking lot I spied what could only be Ken Tennessen's license plate. Somehow the discussion at Gainesville last year came around to "Odonata" on license plates and we high-fived after learning we each had Odonata plates.

As I was shooting a picture of his Wisconsin plate I saw another plate which I assumed was John Abbott's Texas plate. They seem to be plentiful. Anybody else out there?

Licensed to ode! A gallery of plates from the DSA Annual Meeting in Pennsylvania.

Dragonfly-motif stained glass window at Hotel Bougainvillea, San José, Costa Rica, 31 May 2015.

Correction

The caption for the rear cover photo of Jim Burns' Ouachita Spiketail (*Cordulegaster talaria*) in Argia volume 27, issue 2, mistakenly stated that the photo was taken in Arizona. It was actually taken in Arkansas. A corrected PDF of this issue was posted on the OdonataCentral web site two days after the issue was initially posted, but individuals who downloaded their copy when it was first available may have a version with the erroneous state assignment. This error was due entirely to the Editor's apparent inability to remember two-letter state abbreviations, and a strong association in her brain between Jim and Arizona!

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 Searles Mazzacano, CASM Environmental LLC, Portland, Oregon, USA 97206, <cmazzacano@gmail.com>. 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 ot 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 Searles Mazzacano, CASM Environmental LLC, Portland, Oregon, USA 97206

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>.

Mission of the Dragonfly Society of the Americas

The Dragonfly Society of the Americas advances the discovery, conservation and knowledge of Odonata through observation, collection, research, publication, and education.

Back cover: **(upper)** Orange-and-black Threadtail (*Protoneura aurantiaca*) pair, La Selva Biological Station, Costa Rica, 2 June 2015. Photo by Josh Lincoln. **(lower)** Delta-spotted Spiketail (*Cordulegaster diastatops*), Huntingdon County, Pennsylvania, June 2015. Photo by Jim Burns.