ISSN 1061-8503

ARGIA

The News Journal of the Dragonfly Society of the Americas

Volume 29 15 December 2017 Number 4

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

ARGIA Vol. 29, No. 4, 15 December 2017

Front cover: *Erpetogomphus eutainia* (Blue-faced Ringtail) male, Gonzales County, Texas, August 2017. Photo by Jim Burns.

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

Bear Prairie: An Odonate Success Story

Tom Kogut, Packwood, Washington <t.kogut@yahoo.com>

Bear Prairie (46.70965°, -121.81819°) is an 84 acre ephemeral sedge meadow located along Forest Road 52 ("Skate Creek Road") in the southern Cascade mountains of Washington. The "prairie" undergoes dramatic seasonal changes; it is a shallow lake from November through April, gradually transforming into an expansive meadow dominated by *Carex* sedges and horsetails from May through October.

A series of lengthy ditches was constructed at Bear Prairie in the early part of the 20th century in an ill-fated attempt to drain the wetland for farming. These ditches, featuring a luxurious growth of yellow pond lilies (*Nuphar polysepala*), have filled in with sediment over the years, and typically turn to mud in late summer (i.e., late August and much of September). This historically resulted in the wetland holding virtually no standing water in most years (a small beaver pond at the eastern end usually did hold a small amount of water, but it was subsequently lost after the dam deteriorated due to lack of maintenance by the beavers).

In 1991 and 1993, while employed as a district wildlife biologist with the Packwood Ranger District of the Gifford Pinchot National Forest, we initiated a project that constructed series of eight potholes at Bear Prairie, each approximately 0.1 acres in size and about eight feet deep. The potholes were created with explosives, a project that would now essentially be impossible in a post-9/11 world. In two cases, adjacent potholes were linked, forming two larger, dumbbell-shaped ponds.

Vegetated ditch at Bear Prairie. Photo by Tom Kogut.

American Emerald (*Cordulia shurtleffi*) flying at Bear Prairie. Photo by Tom Kogut.

The stated objective of the project was to create late-season brood rearing habitat for waterfowl, particularly during drought years. Although the potholes did provide some benefits to nesting ducks and geese as well as other birds, by far the greatest benefits of the permanent water provided by the created ponds have been to numerous species of invertebrates, as well as amphibians like rough-skinned newts and Pacific treefrogs, based on my own informal monitoring. Reptiles such as garter snakes and mammals such as raccoons, deer, and elk also regularly utilize the potholes for foraging and drinking.

Odonates in particular have benefited significantly from the in

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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
SE DSA 2018	mid-late May 2018	Sanford, North Carolina	Jerrell J. Daigle <jdaigle@nettally.com>
Ohio Odo-Con-18	22–24 June 2018	Hancock County, Ohio	Jim Lemon <jlem@rwoh.rr.com>
Annual DSA Meeting	10–17 July 2018	Finley, Minnesota	M. Haag <Mitchell.Haag@threeriverparks.org>

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the created ponds. Over the years, I have recorded a total of 18 species at Bear Prairie (see Table 1). Unfortunately, no pre-project inventory occurred—invertebrate habitat not being a stated objective at the time—so it is not possible to compare present presence and abundance to a baseline condition, but it is reasonable to assume that at least some odonate species like Northern Bluet (*Enallagma annexum*), Pacific Forktail (*Ischnura cervula*), Western Forktail (*I. perparva*), Swift Forktail (*I. erratica*), American Emerald (*Cordulia shurtleffii*), Ringed Emerald (*Somatochlora albicinta*), and Dot-tailed Whiteface (*Leucorrhinia intacta*) would occur in far less abundance (or possibly not at all) without the aquatic habitat provided in the excavated ponds.

In the 25 years of monitoring since the first potholes were completed, the created ponds had always maintained at least some standing water in them, even during very dry summers. The summer of 2017, one of the driest on record in the southern Cascades, saw this streak snapped, with several of the potholes drying up completely in mid- to late August. Approximately half of them did retain a token amount of water before a rainstorm in mid-September provided some relief and the ponds started to refill. These few inches of aquatic refugia was the only available water in the entire wetland for a three or four week period, a situation that may potentially become more common due to climate change.

It is likely that more intensive monitoring of Bear Prairie would increase the odonate species list and lead to the discovery of other invertebrate species utilizing the created ponds. I look forward to visiting the site again next summer and beyond to discover if the drought of 2017 results in any short- or long-term changes to odonate occurrence or abundance, or if new species will find their way to this unique and ecologically valuable landscape feature.

Lestes dryas (Emerald Spreadwing) at Bear Prairie. Photo by Tom Kogut.

Table 1. Odonate species list for Bear Prairie, Gifford Pinchot National Forest, Washington.

Zygoptera (Damselflies)
Northern Spreadwing (*Lestes disjunctus*)
Emerald Spreadwing (*L. dryas*)
Northern Bluet (*Enallagma annexum*)
Pacific Forktail (*Ischnura cervula*)
Western Forktail (*I. perparva*)
Swift Forktail (*I. erratica*)

Anisoptera (Dragonflies)
Paddle-tailed Darner (*Aeshna palmata*)
Shadow Darner (*A. umbrosa*)
0American Emerald (*Cordulia shurtleffii*)
Ringed Emerald (*Somatochlora albicinta*)
Mountain Emerald (*S. semicircularis*)
Dot-tailed Whiteface (*Leucorrhinia intacta*)
Eight-spotted Skimmer (*Libellula forensis*)
Four-spotted Skimmer (*L. quadrimaculata*)
Common Whitetail (*Plathemis lydia*)
Cardinal Meadowhawk (*Sympetrum illotum*)
Striped Meadowhawk (*S. pallipes*)
Autumn Meadowhawk (*S. vicinum*)

Bear Prairie pothole wetted (upper) and dried down in August (lower). Photos by Tom Kogut.

Hot Odes and Odo-nuts on the San Bernardino Dragonfly Blitz

Doug Karalun <dkaralun@roadrunner.com> **and Kathy Biggs** <bigsnest@sonic.net>

On a warm morning in late June, four 'odonauts' gathered to brave the relentless Mojave Desert heat in search of desert dragonflies. This would be the West Coast DSA/California Blitz, held 29 June–1 July 2017. I met Sandra Hunt-von Arb from McKinleyville and Dave and Kathy Biggs from Sebastopol for the first of three days of dragonfly hunting in San Bernardino County, California.

Our first stop was a place many people have passed on I-15 on their way to Las Vegas from southern California and wondered what is on that road with the funny spelling of Zzyzx. At the end of a partially paved road is the Desert Studies Center, associated with the California State University system. Along the drive to the Center you may see desert bighorn sheep on the hillside. Much to your surprise when you do make it to the end, you will find unexpected ponds being fed by natural springs, in an otherwise bone-dry landscape. The first pond quickly yielded Western Pondhawks (*Erythemis collocata*), Comanche Skimmers (*Libellula comanche*), and Desert Forktails (*Ischnura barberi*). Tule and Familiar Bluets (*Enallagma carunculatum* and *E. civile*) and Common Green Darner (*Anax junius*) were also sighted. After some more extended searching we also turned up Bleached Skimmer (*Libellula composita*), Flame Skimmer (*L. saturata*), and Roseate Skimmer (*Orthemis ferruginea*), bringing our total for the stop to 13 species.

The next stop was Afton Canyon, often referred to as "Grand Canyon of the Mojave", where the sandy Mojave River briefly rises above ground, giving a small bit of surface water. Desert Firetails (*Telebasis salva*) were found and with a bit of searching and a little perseverance, Sandra was lucky enough to get her lifer Gray Sanddragon (*Progomphus borealis*). Black-fronted Forktail

Bison Snaketail (*Ophiogomphus bison*). Photo by Dave Biggs.

Deep Creek, Splinter's Cabin Day Use Area, San Bernardino County, California. Photo by Dave Biggs.

(*Ischnura denticollis*) and California Dancer (*Argia agrioides*) also made a showing, bringing us to 17 species and lunchtime.

Our final stop of our first day was Harper Dry Lake in the western part of the county. There might have been natural spring-fed ponds in the past, but now the ponds are filled as mitigation for the vast solar plant. The temperature had soared to 105°F at this time of day, so many dragonflies were perching in the shade on the east side of the reeds. There were probably about 50 Bleached Skimmers perched, giving our group great views; no one could remember seeing so many of these at one time. Expected Desert Forktails were present and Sandra was able to find a Rambur's Forktail (*Ischnura ramburii*) amongst them, bringing us to 19 species for the day. After a full day in the >100°F heat it was time to call it a day.

On our second day of the blitz we added another participant, BJ Stacey from San Diego, California. This day we headed up into the San Bernardino Mountains, where this leg of the blitz would be a pleasant change from the heat of the prior day. It was also going to be a special day because Kathy Biggs was looking to get her final two California breeding odes, Lavender Dancer (*Argia hinei*) and Serpent Ringtai (*Erpetogomphus lampropeltis*).

Our first stop of this day was at Splinter's Cabin Recreation Area near Lake Arrowhead. Deep Creek becomes a steep canyon at this point and is a clear, rocky stream before it continues north and meets the Mojave River in the high desert north of the San Bernardino Mountains. Before we even exited the parking lot, Kathy was able to get her lifer Lavender Dancer. A short walk down to the stream produced American Rubyspot (*Hetaerina americana*), Western Forktail (*Ischnura perparva*), Bison Snaketail (*Ophiogomphus bison*), Red Rock Skimmer (*Paltothemis lineatipes*), Vivid Dancer (*Argia vivida*), and Sooty

Dancer (*A. lugens*). Overall abundance and diversity is very good at this location. After a busy hour of ode-ing, the California form of Serpent Ringtail (*Erpetogomphus lampropeltis lampropeltis*) landed on the rocky canyon wall. Second target found for Kathy! Two more hours of looking turned up many of the other hard-to-find odes in Southern California, including Western River Cruiser (*Macromia magnifica*), Pacific Spiketail (*Cordulegaster dorsalis*), Grappletail (*Octogomphus specularis*), Walker's Darner (*Aeshna walkeri*) and Cardinal Meadowhawk (*Sympetrum illotum*). Deep Creek gave us 19 species after three hours, with many of them being new for the trip, and we had 37 for the blitz at this time. We all had a lunch on the streamside before heading to our next stop.

Lake Arrowbear is a seasonal stream fed lake to the east of Running Springs. I was hoping to turn up a Common Whitetail (*Plathemis lydia*) as they are rare in Southern California, but it was not to be. We did find our first Emerald Spreadwings (*Lestes dryas*), bringing our trip total to 38 species.

Our final ode-ing destination of the day was Bluff Lake, south of Big Bear. This dammed stream at 7,500 ft elevation has a relict population of lodgepole pines surrounding it. Emerald Spreadwing, Northern Bluet (*Enallagma annexum*), and Boreal Bluet (*E. boreale*) were present in large numbers. As evening was approaching quite a few darners were hunting over the lake, but after much netting we were only able to turn up Blue-eyed Darner (*Rhionaeschna multicolor*) and Common Green Darner (*Anax junius*). Following a full day of ode-ing it was time for dinner. After dinner I led the group on what was to be an unfortunate snipe hunt for Mexican Whip-poor-will, for which I hope Dave forgives me.

Our final day brought us one more participant in Matt Grube from Redlands, California. This final day of the blitz would see a return to 100˚F+ heat so I wanted to visit the confluence of the Mojave River and Deep Creek early.

This lower section of Deep Creek is a slow and sandy stream with some recent beaver ponds. Two of the targets at this location were the similar-looking Aztec and California Dancers (*Argia nahuana* and *A. agrioides*). When the light is just right the brown wing veins of the Aztec Dancer stand out quite vividly and the difference can be easily noted. In other lighting it is not quite so apparent and you have to resort to netting to confirm the identification. This site gave us Pale-faced Clubskimmer (*Brechmorhoga mendax*) doing a spin-dry after dipping its abdomen in the water. Before leaving, Sandra was able to find her lifer Giant Darner (*Anax walsinghami*), which is always a treat, as is seeing Sandra's victory dance. At this time we had 40 total species for the blitz. Also at this site were our lone Blue Dasher (*Pachydiplax longipennis*), Wandering Glider (*Pantala flavescens*), and Arroyo Bluet (*Enallagma praevarum*).

Our next stop was Lost Lake, a seep pond on the San Andreas Fault in the Cajon Pass. We bypassed Cajon Creek, which is still recovering from the debris flows it suffered following the devastating wildfires last fall. Lost Lake gave us more Bleached Skimmers, which were missed on the first day by our new participants, as well as Giant Darners. Amazingly, it was the first time during the blitz when everyone was able to get a good sighting of both Black and Red Saddlebags (*Tramea lacerata* and *T. onusta*). They ended up being fairly sparse considering the numbers of other odes being seen. We also saw a Variegated Meadowhawk (*Sympetrum corruptum*) here.

The final two stops were in the eastern portion of the San Bernardino Valley, in the community of East Highland. The first was at Plunge Creek, which is a natural rocky creek emerging from the foothills of the San Bernardino Mountains. Neon Skimmer (*Libellula croceipennis*) was found in the shade, just as Kathy had predicted it would be. Pacific Forktail was found here as well.

The temperature had climbed to over 100˚F and everyone was slowing down, so we traveled a few miles west where we spent some time along the grassy and shaded shore of the East Highland Reservoir that sits on the San Andreas Fault. Much to our delight, Mexican Amberwing (*Perithemis intensa*) and Red-tailed Pennants (*Brachymesia furcata*) gave us a festive show. After three days and 44 species it was a good time to call an end to the blitz. We happily adjourned to my air-conditioned home for a home-cooked meal, craft beverages, and lively conversation about our whirlwind blitz.

Blitz Species List

ZYGOPTERA (DAMSELFLIES)

American Rubyspot (*Hetaerina americana*)
Emerald Spreadwing (*Lestes dryas*)
California Dancer (*Argia agrioides*)
Lavender Dancer (*A. hinei*)
Sooty Dancer (*A. lugens*)
Aztec Dancer (*A. nahuana*)
Vivid Dancer (*A. vivida*)
Northern Bluet (*Enallagma annexum*)
Boreal Bluet (*E. boreale*)
Tule Bluet (*E. carunculatum*)
Familiar Bluet (*E. civile*)
Arroyo Bluet (*E. praevarum*)
Desert Forktail (*Ischnura barberi*)
Pacific Forktail (*I. cervula*)
Black-fronted Forktail (*I. denticollis*)
Westerm Forktail (*I. perparva*)
Rambur's Forktail (*I. ramburii*)
Desert Firetail (*Telebasis salva*)

ANISOPTERA (DRAGONFLIES)

Walker's Darner (*Aeshna walkeri*)
Common Green Darner (*Anax junius*)
Giant Darner (*A. walsinghami*)
Blue-eyed Darner (*Rhionaeschna multicolor*)
Serpent Ringtail (*Erpetogomphus lampropeltis lampropeltis*)
Grappletail (*Octogomphus specularis*)
Bison Snaketail (*Ophiogomphus bison*)
Gray Sanddragon (*Progomphus borealis*)
Pacific Spiketail (*Cordulegaster dorsalis*)
Western River Cruiser (*Macromia magnifica*)
Red-tailed Pennant (*Brachymesia furcata*)
Pale-faced Clubskimmer (*Brechmorhoga mendax*)
Western Pondhawk (*Erythemis collocata*)
Neon Skimmer (*Libellula croceipennis*)
Comanche Skimmer (*L. comanche*)
Bleached Skimmer (*L. composita*)
Flame Skimmer (*L. saturata*)
Roseate Skimmer (*Orthemis ferruginea*)
Mexican Amberwing (*Perithemis intensa*)
Blue Dasher (*Pachydiplax longipennis*)

California form of the Serpent Ringtail (*Erpetogomphus lampropeltis lampropeltis*). Photo by BJ Stacey.

Red Rock Skimmer (*Paltothemis lineatipes*)
Wandering Glider (*Pantala flavescens*)
Variegated Meadowhawk (*Sympetrum corruptum*)
Cardinal Meadowhawk (*S. illotum*)
Black Saddlebags (*Tramea lacerata*)
Red Saddlebags (*T. onusta*)

2018 SE DSA Regional Meeting

Mike Turner <wmiketurner@gmail.com> **and Jerrell J. Daigle** <jdaigle@nettally.com>

The 2018 SE DSA Regional Meeting will be held in Sanford, North Carolina, where it will hosted by Mike Turner <wmiketurner@gmail.com>. Sanford is just southwest of Raleigh off of US Highway 1. The dates are Friday 11 May to Sunday 13 May, but folks may be arriving earlier on Thursday night and staying until Monday or Tuesday.

Our base motel in Sanford is the Holiday Inn Express, with its hot breakfast bar. We have reserved 15 rooms, five with a king bed and 10 with two double beds, for the dates of 10–14 May. To reserve a room, call 919-776-6600 and ask for Angie. Please mention SEDSA to get the group rate of $89.00 plus tax. Nearby motels include Hampton Inn (919-775-2000) and Baymont Inn (919-708-7400). Cheaper motels further away are Days Inn (919-213-7235) and Economy Inn (919-774-6411). Nearby restaurants include Sagebrush Steakhouse, Brass Kettle Family Restaurant, and several Mexican restaurants, at one of which we plan to have our dinner either Friday or Saturday night. Also, Piggly Wiggly and Walmart are nearby if one needs to get supplies.

Collecting sites include the Sandhills Game Lands, McKinney Lake Fish Hatchery, Lumber River State Park, Raven Rock State Park, and Deep River, which is a site for our target species, *Gomphurus septima* (Septima's Clubtail). Weymouth Woods-Sandhills Nature Preserve is good for rare hairstreak butterflies


Septima's Clubtaill (*Gomphurus septima*), a target species for the 2018 SEDSA meeting. Chesterfield County, South Carolina, 9 May 2008. Photo by Jim Johnson.

like King's Hairstreak (*Satyrium kingi*) and Edwards' Hairstreak (*S. edwardsii*). These areas contain acres of streams, swamps, rivers, ponds, and creeks. For more information on bird, butterfly, and dragonfly species found around Sanford, please contact us by e-mail. Let us know if you have any questions. You do not need to be a member of DSA to attend. Hope to see you there!

Painted Damsel (*Hesperagrion heterodoxum*)—the Canyon Gem of the Southwestern U.S.

Jerry K. Hatfield <l.hatfiejk7@gmail.com>

Throughout North America and around the world, every regional habitat has its own distinct dragonflies and damselflies. If the odonate enthusiast sets out in search of the "canyon gem" damselfly commonly known as the Painted Damsel (*Hesperagrion heterodoxum*), she/he is advised to target the southwestern U.S. and Mexico. More specifically, within the southwestern U.S. itself, mountain and desert canyon streams (both permanent and ephemeral) with moderate emergent vegetation are habitats consistent with the presence of *H. heterodoxum*. Multiple sites in the Texas Trans-Pecos region as well as throughout the southern half of both the southwestern states of Arizona and New Mexico have been shown to be established distribution sites for *H. heterodoxum*, according to information obtained from the OdonataCentral website.

As with many other distinct Odonata, seeing and photographing this species is always a highlight of any southwestern ode adventure. My very first encounter with this distinctively incandescent damselfly—replete with spectacular large red eyespots to match its equally red abdominal tip—occurred in in Texas' McKittrick Canyon in the Guadalupe Mountains National Park (Culberson County), and it was a sight worth beholding. Furthermore, I conclude that laying my eyes on this striking little beauty is nearly as eye-popping as beholding the radiant glow of the Neon Skimmer (*Libellula croceipennis*), although on a much smaller scale! It is truly amazing what treasures await those exploring the far reaches of the stark canyons of the desert southwest. So if you are hoping for the chance to get a good look at the Painted Damsel, to the southwestern U.S. you must go!

As I mentioned, for the Texas native explorer, the Trans-Pecos region contains various sites for getting a closer look at this distinctive "canyon gem" damselfly. The only caveat to that is, if by some strange luck, you just happen to be able to glimpse one somewhere east of the Trans-Pecos. And in fact, this is just what happened on the Texas South Plains in the residential neighborhood backyard in Lubbock (Lubbock County) of budding odonate enthusiast Brian Cornwell. Several years ago, I introduced Brian (a workplace colleague of mine) to the fascinating world of odonates. Since that time, he has periodically drawn my attention to several species he has encountered in his backyard and elsewhere. Recently, he approached me with a slightly out-of-focus photo he took of a beautiful damselfly that caught his eye on 22 September 2017. The iPhone image of the damselfly in question was perched on a plant leaf in his backyard and was observed while he was pulling weeds that day. I was simply astounded when I laid my eyes on the impossible image of a mature male Painted Damsel (*H. heterodoxum*). Indeed, I found myself in a state of such disbelief that I immediately pressed him to confirm the location of the photo, and he again affirmed that he observed and photographed it in his backyard. Later, after sending out messages accompanied by his photo to odonate experts both near and far, I wasted little time and submitted the record to OdonataCentral (OC# 473521). The submission of the *H. heterodoxum* photo and its subsequent confirmation brought the total number of species for Lubbock County, Texas to 70. But more than that, it established unmistakable evidence for this species' occurrence (accidentally?) far from its normal distribution range.

Don't Forget to Renew Your DSA Membership in 2018!

As we say farewell to another year, it's time to add "renew my DSA membership" to your holiday to-do list. Annual dues are only $15, and include: electronic subscriptions to Argia, the news journal of the DSA, and Bulletin of American Odonatology (BAO), the DSA's peer-reveiewed research journal; full access to OdonataCentral, including online membership list and searchable archived editions of Argia and BAO; fee discounts at annual DSA meetings; and eligibility to vote in DSA elections and run for a seat on the DSA Executive Committee. A sustaining membership of just $20 (or more!) provides even more support for our organization. And, if you find annual renewals hard to remember, you can pay dues for multiple years at once.

Dues can be paid online using a credit card, or you can print out the membership form and mail it back along with a check or money order. You can find membership information and forms on the OdonataCentral web site at <https://www.odonatacentral.org/index.php/PageAction.get/name/DSA_Membership>. Please note that you will need to be logged in to your OdonataCentral account to access the credit card payment. Thank you for supporting the DSA!

Golden-mantled Ground Squirrel, a Surprising Predator on a Dragonfly

Dennis Paulson, Seattle, Washington <dennispaulson@comcast.net>

On 27 August 2017, Netta Smith and I were at the south end of Crane Prairie Reservoir, Deschutes County, Oregon, looking for dragonflies. Netta was watching a Golden-mantled Ground Squirrel (*Callospermophilus lateralis*) on top of a big log, when it suddenly reared up, seeming almost to jump into the air, and then disappeared under the log. She called me over, and I went around to the other side of the log and found the squirrel eating a mature male *Aeshna palmata* (Paddle-tailed Darner). From only this circumstantial evidence, we think that it is likely that the squirrel caught the dragonfly in the air when it performed its sudden maneuver. Male *Aeshna* had been flying and hovering all around us, over the water and land.

I watched it for about three minutes as it devoured the dragonfly headfirst. I turned away for a few seconds as it was eating the abdomen, and when I looked back nothing was left but four wings neatly arrayed on the ground. The squirrel soon appeared on top of the log again.

I have always thought that ground squirrels were pure herbivores, but reading about this species informed me that it eats a great amount of animal matter, including all kinds of adult and larval insects all the way up in size to lizards, birds and eggs, and small mammals, including trapped chipmunks and road kills of its own species (Bartels and Thompson, 1993)! So a dragonfly is nothing special, except the difficulty of capturing one, and this squirrel apparently had figured that out.

Literature Cited

Bartels, M.A. and D.P. Thompson. 1993. *Spermophilus lateralis*. Mammalian Species No. 440. American Society of Mammalogists, pp. 1–8.

Golden-mantled Ground Squirrel dining on dragonfly.

Spiders Residing in Odonate Exuviae: Third Update

Tim Manolis <ylightfoot@aol.com>

My paper "Odonate exuviae used for roosts and nests by *Sassacus vitis* and other jumping spiders (Araneae: Salticidae)" has been published (Peckhamia 142.1, 3 June 2016, 1–17) and is available for download at <http://peckhamia.com/peckhamia/PECKHAMIA_142.1.pdf.>

In my last update (Argia 25(1): 24), I mentioned that a couple of jumping spiders had been found in exuviae collected in Tennessee by Jim Johnson, and I tentatively identified them as *Pelegrin*a sp. I subsequently had these spiders correctly identified, courtesy of Dr. G. B. Edwards of the Florida State Collection of Arthropods, as being female *Zygoballus nervosus*. One of these salticids was found in an exuvia of *Erythemis simplicicolli*s (Eastern Pondhawk) at Williamsport Wildlife Management Area, Maury County, Tennessee, on 10 June 2012; the other was found in an exuvia of *Gomphurus vastus* (Cobra Clubtail) at Peeler Park on the Cumberland River, Davidson County, Tennessee, on 11 June 2012. Dr. Edwards wrote: "This species is found in wet habitats and they are small . . ., which I think would make them a good candidate to utilize dragonfly exuviae."

Call for Papers for Bulletin of American Odonatology (BAO)

The Bulletin of American Odonatology needs your submissions for the timely reporting of research on Odonata of the New World. Submitted articles may include faunal synopses, behavioral analyses, and ecological studies. See the last page of this issue of Argia for BAO publishing guidelines or contact Steve Hummel, BAO Editor, at <editor@dragonflysocietyamericas.org>.

New Discovery of Larvae of *Epiaeschna heros* (Swamp Darner) in the City of Gatineau, Québec, Followed by Emergence of One Indvidual at the Second Author's Home

Raymond Hutchinson <hutchinson.r@videotron.ca> **and Benoît Ménard**

On 27 August 2016, on a tip from a friend, Majella Larochelle, the three of us briefly explored a forest swamp in search of a very rare species of salamander for the province of Québec. The habitat, a series of very shallow, interconnected ponds, lies in a forested section of Lake Beauchamp Municipal Park, situated in the eastern area of the city of Gatineau (population approximately 300, 000). To our great astonishment, BM unexpectedly collected two mature larvae of *Epiaeschna heros* (Swamp Darner), while his wife Line netted one adult specimen. The three nymphs were brought alive to BM's home in the hope of witnessing an emergence, which happened in the case of one of the collected larvae. On 20 August 2017, BM found three exuviae hanging from a tree trunk in the same habitat.

Newly-emerged Swamp Darner (*Epiaeschna heros*) in the second author's home. Photo by Benoît Ménard.

Swamp Darner (*Epiaeschna heros*) habitat in Lake Beauchamp Municipal Park, Gatineau, Québec. Photo by Benoît Ménard.

One of the Swamp Darner (*Epiaeschna heros*) nymphs brought home to rear to adulthood. Photo by Benoît Ménard.

The type of habitat is very interesting as far as plant species composition is concerned. The main plant taxa inhabiting the swamp and immediate surroundings are Red Maple (*Acer rubrum*), Common Winterberry (*Ilex verticillata*), *Sphagnum* sp. and Sensitive-Fern (*Onoclea sensitiva* L.), probably growing in somewhat acid waters. The bottom of the pond was littered with dead leaves and branches of various sizes and diameter. The water depth anywhere in the marsh never surpassed 14 or 15 inches.

This is the second habitat at Lake Beauchamp where a number of larvae and exuviae of *Epiaeschna* have been found and collected.

Swamp Darner (*Epiaeschna heros*) exuviae found clinging to a branch. Photo by Benoît Ménard.

Splash-dunk/Spin-dry Analysis for 2011–2017

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

Dragonflying is always fun; in fact, my wife Betsy and I consider it to be one of the most pleasurable activities of the year. It's even more enjoyable, however, when we get to observe the suite of behaviors we refer to as the splash-dunk/spin-dry (Walker, 2011). Once again this dragonfly season, as in years past, we recorded all the splash-dunk events we observed. The number of events for 2017 was 86; this brings the total number observed since 2011 to 688.

To be specific about the terminology, a splash-dunk event begins when a dragonfly slams into the water at full speed to bathe, and comes to a complete stop in the process. If the dragonfly gains altitude after the splash-dunk and performs a 1,000 rpm spin-dry (Walker, 2014) to shed the water it picked up, it was a one splash-dunk event. If the dragonfly does two splash-dunks, then rises for a spin-dry, it's a two splash-dunk event, and so on. Each time we see an event beginning, we count the number of splash-dunks performed by the dragonfly before the spin-dry. This type of data provides the basis for the splash-dunk distribution charts given below.

In this article, we present details from our observations in 2017, including a striking spate of splash-dunks performed by meadowhawks. We also discuss some of the significant trends that appear in the cumulative data from 2011 to present.

Splash-Dunk Distribution for 2017

With 86 splash-dunks this year, we have enough data to construct a meaningful splash-dunk distribution chart., i.e., the number of events corresponding to one splash-dunk, two splash-dunks, etc. The number of splash-dunks per event ranged from one to seven in 2017 (Figure 1).

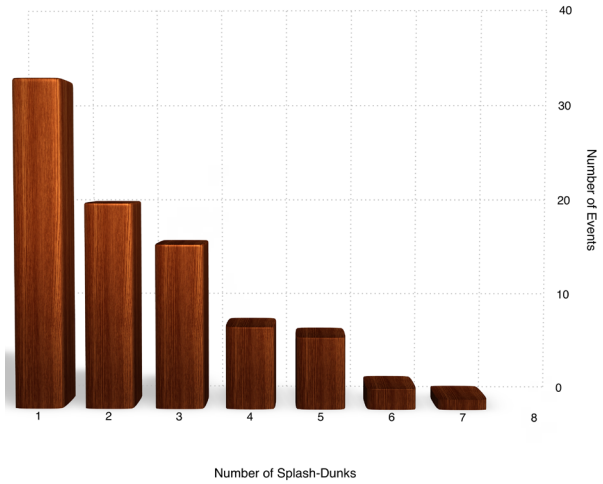

Figure 1. Splash-dunk distribution for 2017

Notice the rapid fall-off in the number of events as the number of splash-dunks increases. This has been a consistent feature of our data over the years. In addition, the average number of splash-dunks per event this year was 2.41, just a bit larger than the cumulative average, as we'll see below.

Mount Baker Observations

An interesting aspect of our observations for 2017 is associated with an afternoon we spent at Mount Baker in northwestern Washington. We were near the ski area, elevation 4,200 ft, at a lovely dragonfly hotspot called Picture Lake. The view at this lake is famous for the reflected image of Mount Shuksan (Figure 2). We visited here on 28August 2017, a day that was sunny and warm, with a temperature of 87°F.

Figure 2. Picture Lake, with Mt. Shuksan in the background.

We generally don't see splash-dunking and spin-drying at this location, but this day was an exception on a few counts. First, there were more species on this day than normal, including Lyre-tipped Spreadwing (*Lestes unguiculatus*), Northern Spreadwing (*L. disjunctus*), Sedge Darner (*Aeshna juncea*), Saffron-winged Meadowhawk (*Sympetrum costiferum*), Black Meadowhawk (*S. danae*), Hudsonian Whiteface (*Leucorrhinia hudsonica*), and Ringed Emerald (*Somatochlora albicincta*). Second, a series of splash-dunks and spin-drys was observed in the smaller pond just across the street and down the hill from Picture Lake.

These splash-dunks occurred at the far side of the pond and were observed with binoculars. The dragonflies doing the splash-dunks were red and the size of meadowhawks. We presume they were Saffron-winged Meadowhawks (see Figure 3), since those were the only red meadowhawks we saw that day—and we saw quite a few of them. We saw 20 splash-dunk events in just about half an hour of observing, after which the activity slowed and we returned to Picture Lake.

There were a couple of interesting aspects to these splash-dunks that set them apart from the ones we observe with darners. First,

after a darner does a series of splash-dunks it gains altitude, does a spin-dry, and then goes to a tree or bush to rest. In contrast, the meadowhawks on that day would do a few splash-dunks, gain some altitude and do a spin-dry, then immediately plunge back into the water for another round of splash-dunks.

The second difference is that when a darner does a splash-dunk it usually approaches the water on a nice, steady glide path until it makes contact. The meadowhawks have a different approach. They tend to gain some altitude and then do an abrupt "dive bomb" back into the water. It was quite interesting to watch the differences in their style.

Cumulative Results for 2011–2017

Next, we present the combined results from all of our splash-dunk observations since 2011, encompassing 688 events (Figure 4). Notice the consistency between these results for the past seven years and those for 2017 in Figure 1. In particular, the overall shape of the distribution is quite similar, although the maximum number of splash-dunks in the cumulative data is eight. This number of splash-dunks has been observed on two occasions, with one of them being the celebrated case of the constipated darner (Walker, 2013).

The average number of splash-dunks per event is 2.32 for 2011–2017, as compared with 2.31 for last year's cumulative data. The difference is only about half of a percent, showing that the statistics obtained from 688 events are quite consistent.

The Splash-Dunk "Sweet Spot"

One final aspect of the results is the near exponential fall-off in the number of events with increasing splash-dunk number. As mentioned last year, we see a departure from an exponential decrease near three splash-dunks. This is shown in Figure 5, where the red dots are the splash-dunk data, and the blue curve is an exponential of the form aExp[–bx], with a = 425 events, b = 0.488/splash-dunk, and x = number of splash-dunks. The exponential fit to the data is quite good, except for the cases of three and four splash-dunks, where we see an excess in the numbers or a "shoulder" in the data. This feature has persisted from year to year, and with the statistics getting quite reliable, it seems to be a real aspect of the splash-dunk behavior.

Figure 3. Saffron-winged Meadowhawk (*Sympetrum costiferum*), like those seen near Picture Lake.

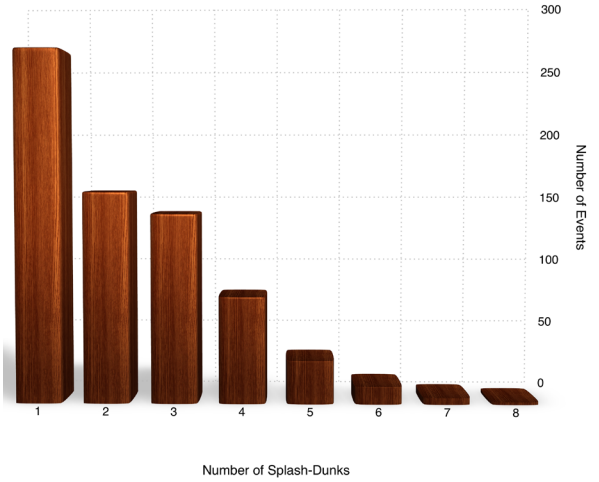

Figure 4. Splash-dunk distribution chart for 688 events from 2011–2017.

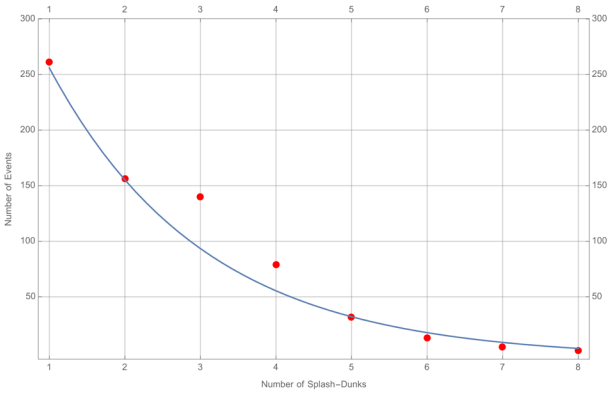

Figure 5. Comparison of splash-dunk data (dots) with an exponential fall-off (curve).

If the fall-off were perfectly exponential, it would indicate that the splash-dunks are independent occurrences, and that each successive splash-dunk happens with equal probability. The excess at three and four splash-dunks shows that these values have an enhanced probability. Perhaps three splash-dunks are often required for a good cleaning, with fewer splash-dunks not quite sufficient, ans more than four splash-dunks are a bit exhausting. In this way, three to four splash-dunks may be a bit of a "sweet spot" for splash-dunking dragonflies.

Acknowledgements

I would like to thank Betsy Walker for help collecting the data presented here.

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New DSA Membership Categories Proposed—Vote Now!

The Executive Committee is proposing that the current DSA membership structure be changed to allow the addition of two new categories: Life Membership and Sustaining Life Membership. These additions will involve changes to our existing bylaws, and as such must be voted on by the DSA membership. A ballot will be created on the DSA website on OdonataCentral <https://tinyurl.com/DSA2017bylaw>. A vote of "yes" indicates acceptance of the proposed membership categories and accompanying changes to Section II, part B of the bylaws (shown in bold text below); a vote of "no" rejects the addition of new membership categories. Please cast your vote no later than 15 February 2018.

Proposed change to bylaws text:

Section II, Part B. All dues and memberships are by the calendar year, without regard for the month in which a member joins the Society, payable with enrollment and on or before March 1 of each succeeding year. Dues are deemed in arrears on July 1 of the current year. **Life membership is available for a single payment of $300 US or Sustaining Life Membership for a single payment of $400 US or more.**

Odonata in the News

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

Chari L.D., S. Moyo, and N.B. Richoux. 2017. Trophic ecology of adult male Odonata. II. Dietary contributions of aquatic food sources. Ecological Entomology DOI: 10.1111/een.12459. Insects that emerge from rivers provide nutritional subsidies to local riparian predators. Adult damselflies and dragonflies often benefit from aquatic resources, but their high mobility and evasiveness have made it difficult to monitor their diets. A dual fatty acid and stable isotope analysis approach was used to investigate the links between Odonata size and behaviour with proportions of their aquatically derived nutritional sources. Additionally, the study investigated the variation in dietary contributions of aquatic food sources to Odonata between two sections of a river, each with different aquatic productivity rates. Variations in body size and foraging method of Odonata in the Kowie River (South Africa) contributed to differences in the contributions of aquatic food sources to their diets. Large Odonata that consumed prey in flight had smaller proportions of aquatic indicator fatty acids and stable isotope-generated proportions of aquatic food sources than did the smaller Odonata that consumed prey from perches. There was a considerable amount of interspecific variation in indicators of aquatic feeding, but Odonata at an upstream site had smaller proportions of aquatic indicators than those at a downstream site which had higher insect emergence rates. The findings of this study contribute information on the dynamics of feeding ecology among adult Odonata, and the substantial contributions of aquatic prey (>80% of total diet in some cases) indicated that cross-boundary trophic linkages via odonates are strong in the Kowie River.

Manolis, T. 2016. Odonate exuviae used for roosts and nests by *Sassacus vitis* and other jumping spiders (Salticidae). Peckhamia 142(1): 1–17. I systematically collected dragonfly (Anisoptera) exuviae along the margins of backwater lagoons in the American River floodplain, Sacramento County, California, USA, in five years (2008–2010, 2012–13) to document and monitor secondary use of these structures by arthropods, particularly spiders. Of nearly 400 exuviae examined, 28.1% were occupied, or showed signs of occupancy (e.g., unoccupied retreats). Of these occupied exuviae, 93% contained spiders or evidence of spider occupancy, and at least 50% of these were occupied by *Sassacus vitis* (many unoccupied retreats were probably of that species as well). *S. vitis* showed a significant preference for using the exuviae of sedentary, burrowing dragonfly larvae versus those of active, clasping or sprawling larvae. I found *S. vitis* in exuviae as single males and females, in pairs, and using exuviae for molt retreats and nests. Thirty-four *S. vitis* nests in exuviae provided data on aspects of the species' breeding biology. In addition, a number of these nests were attacked by hymenopteran egg parasitoids in the genera *Idris* (Platygastridae) and *Gelis* (Ichneumonidae). I also found three other salticid species (*Sitticus palustris*, *Synageles occidentalis*, and *Peckhamia* sp.) in exuviae, all guarding egg sacs. Utilization of dragonfly exuviae by *Sassacus vitis* and other salticids is no doubt more frequent and widespread than previously noticed and deserves further scrutiny.

May M.L., J.A. Gregoire, S.M. Gregoire, M.A. Lubertazzi, and J.H. Matthews. 2017. Emergence phenology, uncertainty, and the evolution of migratory behavior in *Anax junius* (Odonata:Aeshnidae). PLoS ONE 12(9): e0183508. https:// doi.org/10.1371/journal.pone.0183508. Mass migrations by Odonata, although less studied than those of Monarch butterflies and plague locusts, have provoked comment and study for many years. Relatively recently, increasing interest in dragonflies, supported by new technologies, has resulted in more detailed knowledge of the species involved, behavioral mechanisms, and geographic extent. In this paper we examine, in four independent but complementary studies, how larval habitat and emergence phenology interact with climate to shape the evolution of migratory strategy in *Anax junius*, a common species throughout much of the eastern United States and southern Canada. In brief, we argue that fish predation on larvae, coupled with the need for ample emergent vegetation for oviposition and adult eclosion, dictates that larval development and survival is optimal in ponds that are neither permanent nor extremely ephemeral. Coupled with annual variation in regional weather and winters in much of their range too cold for adult survival, conditions facing newly emerged *A. junius* may unpredictably favor either local reproduction or long-distance movement to more favorable areas. Both temperature and hydroperiod tend to favor local reproduction early in the adult activity period and migration later, so late emerging adults are more likely to migrate. No single pond is always predictably suitable or unsuitable, however, so ovipositing females also may spread the risk to their offspring by ovipositing at multiple sites that, for migrants, may be distributed over very long distances.

Modiba R.V., G.S. Joseph, C.L. Seymour, P. Fouché, and S.H. Foord. 2017. Restoration of riparian systems through clearing of invasive plant species improves functional diversity of odonate assemblages. Biological Conservation 214: 46–54. Riparian systems are threatened globally, but contribute disproportionately to biodiversity and ecosystem function. Restoration to reverse their loss is costly, and requires careful monitoring and evaluation. Odonates are amongst the most reliable arthropod bioindicators for monitoring riparian ecosystems. Despite functional diversity (FD) reflecting ecosystem pattern and processes better than taxonomic diversity, odonate FD has yet to be used in evaluating riparian conservation and restoration outcomes. We surveyed 45 sites across six river-systems in northeastern South Africa, to compare odonate FD and standardised effect size of odonate FD (sesFD) in riparian systems that had been invaded by alien plants, cleared of alien invasives, and sites that had never been invaded (15 sites each). Although species richness did not differ between treatments, odonate sesFD was lower in invaded sites than those that had been cleared of alien riparian vegetation and those that had never been invaded. Clearance of 40% of alien riparian vegetation was associated with sesFD greater than that of invaded sites by almost two standard deviations. Representation of traits varied between treatments but was similar between cleared and natural sites, suggesting that invasion by alien plants directly impacts food webs, and that clearance can restore ecosystem processes and ecological services. This study confirms that odonate FD can respond to restoration efforts. Secondary impacts of restoration to complete suites of functional groups can be anticipated to enhance ecological services and impact food webs at a range of scales.

Tennessen, K.T., R.B. DuBois, and K. Hemeon. 2017. Description of the last stadium nymph of *Ladona exusta* (Say) (Odonata: Libellulidae). Entomologica Americana 123(1-4): 1–8. *Ladona exusta* (Say) is a small libelluline dragonfly restricted to the Atlantic coastal region of North America from southern Newfoundland to Virginia. Based on 20 nymphs collected in shallow ponds in Massachusetts, New Jersey and New York, we describe the final unknown nymph of the genus. The palps have 5 major setae, differing from its more widespread congeners, *L. deplanata* and *L. julia*, which normally have 6 on each side, sometimes 7 (rarely 5 or 8). Nearly all *L. exusta* nymphs can be separated from *L. deplanata* using the number of palpal setae (5 v. 6) in conjunction with the ratio of epiproct length to metafemur length (0.42–0.48 v. 0.49–0.67). *L. exusta* is smaller than *L. julia* in a number of characters, the most distinctive of which are prementum length (3.70–3.90 mm vs. 3.90–4.75 mm) and prementum maximum width (3.35–3.85 mm vs. 3.90–4.85 mm).

Uiterwaal S.F., C. Mares, and J.P. DeLon. 2017. Body size, body size ratio, and prey type influence the functional response of damselfly nymphs. Oecologia 185(3): 339–346. Predator–prey interactions play a crucial role in structuring food webs, and the functional response is one way to measure the strength of this interaction. Here, we examine how predator and prey body size affects the functional response of a generalist predator—damselfly nymphs—feeding on three prey types: copepods, *Daphnia*, and *Chydorus*. Our results suggest that consumption of copepods is independent of predator body size, while increased predator body size is associated with an increased space clearance rate for *Daphnia* and a reduced space clearance rate for *Chydorus*. When considered together, foraging rates on *Daphnia* and *Chydorus* (both cladocerans) are consistent with a hump-shaped functional response, with peak foraging rates occurring at an intermediate predator–prey size ratio. Thus, although most food web theory assumes allometric predator–prey links or peaked functional responses at intermediate predator–prey size ratios, our results suggest that both relationships may occur in food webs, in addition to size-independent functional responses.

White III, H.B. and M.F .O'Brien. 2017. Naming an undescribed dragonfly: Williamson's *Williamsonia* and the travails of R. Heber Howe Jr. Northeastern Naturalist 24(m14): 1–43. R. Heber Howe Jr. (1875–1932), a New England preparatory school teacher and natural historian, became interested in dragonflies after one of his students found the rare *Williamsonia lintneri* (Hagen) (Ringed Boghaunter) on school property. Subsequently, Howe quickly became a prominent regional authority on Odonata through his own studies and through his frequent correspondence with E.B. Williamson and other established dragonfly authorities. In 1922, while Howe was drafting an article on the history of *W. lintneri*, Williamson discovered a second species of *Williamsonia*, which Howe may have also recognized. Correspondence archived from this period reveals a dispute between Howe and Williamson about naming and describing the new species that peripherally involved Philip P. Calvert and Clarence H. Kennedy, other well-established dragonfly specialists, and Canadian entomologists James H. McDunnough and Edmund M. Walker. Howe's position in the dispute that the new species had previously been named in the literature, though not formally described, did not prevent Williamson from describing and naming *Williamsonia fletcheri* (Ebony Boghaunter). Yet behind the scenes, expressed in letters, the saga reveals tensions that can develop, exposing personality traits, among specialists with competing interests.

Zheng, D., A. Nel, E.A. Jarzembowski, S.-C. Chang, H. Zhang, F. Xia, H. Liu, and Bo Wang. 2017. Extreme adaptations for probable visual courtship behaviour in a Cretaceous dancing damselfly. Scientific Reports 7(44932); doi: 10.1038/srep44932. Courtship behaviours, frequent among modern insects, have left extremely rare fossil traces. None are known previously for fossil odonatans. Fossil traces of such behaviours are better known among the vertebrates, e.g. the hypertelic antlers of the Pleistocene giant deer *Megaloceros giganteus*. Here we describe spectacular extremely expanded, pod-like tibiae in males of a platycnemidid damselfly from mid-Cretaceous Burmese amber. Such structures in modern damselflies, help to fend off other suitors as well as attract mating females, increasing the chances of successful mating. Modern Platycnemidinae and Chlorocyphidae convergently acquired similar but less developed structures. The new findings provide suggestive evidence of damselfly courtship behaviour as far back as the mid-Cretaceous. These data show an unexpected morphological disparity in dancing damselfly leg structure, and shed new light on mechanisms of sexual selection involving intra- and intersex reproductive competition during the Cretaceous period.

ID Corner: Identifying partly grown nymphs: ontogenic instability in lateral spine lengths of *Neurocordulia yamaskensis* (Stygian Shadowdragon), by Robert DuBois, Ken Tennessen, and Matthew Berg

ID Corner addresses the challenges we face as print and electronic identification resources blossom, and more newcomers come into the dragonflying fold. DSA members range from those who pore over in-hand or microscopic features to hands-off observers who want to know the best field marks to identify an individual to species. Excellent information can be found on many different Facebook page threads and e-mail list serves, but even the most detailed post can be lost or buried. This ID-themed section provides more structure and accountability than those myriad Facebook threads (even though it is not peer-reviewed).

We hope additional DSA members with expertise will contribute notes in the future. Readers can also ask about specific topics for future issues. Topics and questions can address aspects of identification of adults, nymphs, or exuviae. If you have any questions, please contact me at <editor@dragonflysocietyamericas.org>.

Identifying partly grown nymphs: ontogenic instability in lateral spine lengths of *Neurocordulia yamaskanensis* (Stygian Shadowdragon), by Robert DuBois, Department of Natural Resources, Superior, Wisconsin <robert.dubois@wisconsin.gov>, Ken Tennessen, Wautoma, Wisconsin <ktennessen@centurytel.net>, and Matthew Berg, Grantsburg High School, Grantsburg, Wisconsin <saintcroixdfly@gmail.com>.

Nymphs of Anisoptera grow through about a dozen instars on average (Corbet, 2002), the last four or five of which are often large enough to be retained by many types of collecting nets. However, identification keys have usually been designed for use only with final instar nymphs (i.e., full-grown or F-0). In a previous note, DuBois and Tennessen (2017) introduced and discussed some of the problems that can arise when using standard keys to identify late-stage nymphs that are not full grown—problems that are often caused by allometric growth rates, or changes in the shapes of diagnostic body parts during ontogeny. In that note they gave preliminary evidence for the relative stability of the lengths of the terminal appendages for instars F-0 through F-3 of *Erpetogomphus* and *Ophiogomphus*, which created the possibility of using states of a single character to distinguish the two genera through those instars. In this note we focus on an example of the opposite case—the ontogenic instability of lateral spine lengths of *Neurocordulia yamaskanensis* (Provancher) (Stygian Shadowdragon)—and the cautions that are therefore required when using current keys.

Methods

As described in DuBois and Tennessen (2017), we measured head width (HW; widest point across the eyes in dorsal view), metathoracic wing sheath length (WSL), and calculated WSL/HW ratios to determine the instar numbers of all nymphs and exuviae. We measured WSL in dorsolateral view from its base at the juncture with the metepimeron to its apex (Tennessen, 2016). We calculated growth ratios (GR) of the measured body parts of the instars examined (e.g. F-4 to F-3, F-3 to F-2, F-2 to F-1, and F-1 to F-0). Growth ratio is the proportionate increase in size of any body part after a molt (Corbet, 1999) and it is useful for determining if growth of the body part is isometric or allometric (see DuBois and Tennessen, 2017). We considered a GR that deviated substantially from 1.26 (a useful mean GR value for hemimetabolous insects like odonates) as showing evidence of allometric growth.

We also measured the lengths of the lateral spines on abdominal segment 9 (LSS9; ventral view), and the longitudinal distance (dorsal view) between the tips of the paraprocts (PP) and the tips of LSS9 of instars F-0 through F-4. Some measurements were omitted on fragmented or missing body parts on two specimens. Final instar nymphs of *N. yamaskanensis* were determined using Needham et al. (2014), which was the only known species of *Neurocordulia* in the river reach sampled that did not possess a pyramidal horn on the frons. Some younger nymphs were reared in captivity to F-0 or F-1 to verify their identity.

Measurements were made to the nearest 0.05 mm with a stereomicroscope equipped with an ocular micrometer calibrated at 6X and 12X, depending on nymph size. Specimens were preserved in 80% ethanol and are housed in the Odonata Collection of the Wisconsin Department of Natural Resources in Superior (managed by RBD). Specimens examined: WISCONSIN, Polk Co., St. Croix River, Interstate State Park, coll. MB (all nymphs, two reared exuviae, four unassociated exuviae); Wood Co., Wisconsin River, Biron/Port Edwards, coll. KT (six unassociated exuviae); Rusk Co., Chippewa River, Bruce, coll. RD (one unassociated exuvia).

Results and Discussion

Growth ratio means of HW averaged 1.30 (range 1.26–1.37) and LSS9 averaged 1.10 (range 0.99–1.22) for the last four instars (Figure 1; Table 1), which suggested isometric growth of both body parts through those instars. In contrast, GR means of WSL averaged 2.01 (range 1.87–2.28) for the same instars (Figure 1; Table 1), indicating allometric growth of that body part. Ratios of WSL/HW increased geometrically from instars F-4 to F-0 (Figure 2; Table 2), and the values were similar to those presented by Tennessen (2016) for *Neurocordulia molesta* (Walsh) (Smoky Shadowdragon).

Table 1. Sample sizes, means, and growth ratios (GR) of head width (HW), lengths of lateral spines on abdominal segment 9 (LSS9), and metathoracic wing sheath length (WSL) for five instars of *Neurocordulia yamaskanensis* in Wisconsin (SEM = standard error of the mean; nd = no data; all measurements in mm).

Instar	*N*	Mean HW (SEM; GR)	Mean LSS9 (SEM; GR)	Mean WSL (SEM; GR)
F-0	14	6.84 (0.09; 1.37)	0.96 (0.03; 1.02)	6.90 (0.11; 2.28)
F-1	5	5.00 (0.07; 1.28)	0.94 (0.05; 1.15)	3.02 (0.08; 1.97)
F-2	9	3.90 (0.03; 1.26)	0.82 (0.02; 0.99)	1.53 (0.03; 1.87)
F-3	12	3.09 (0.06; 1.28)	0.82 (0.02; 1.22)	0.82 (0.02; 1.93)
F-4	4	2.41 (0.06; nd)	0.67 (0.03; nd)	0.42 (0.01; nd)

Relative lengths of LSS9 differed dramatically between F-0 and younger nymphs. Most F-0 nymphs and exuviae (79%) had PP tips that extended rearward slightly further than the tips of LSS9 by a mean distance of 0.1 mm (Fig-

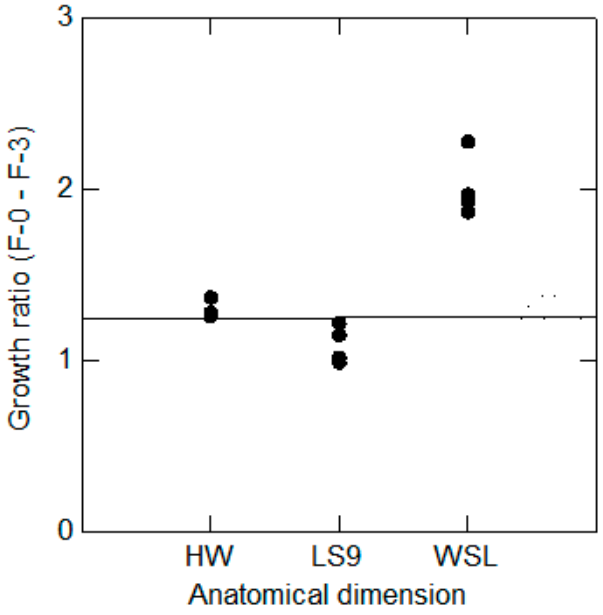

Figure 1. Mean growth ratios for head widths (HW), length of lateral spines on abdominal segment 9 (LS9), and length of metathoracic wing sheaths (WSL) for instars F-0 through F-3 of *Neurocordulia yamaskanensis* in Wisconsin. The horizontal line marks the growth ratio considered to be typical of hemimetabolous insects (1.26). Note that growth of HW and LS9 was close to isometric, but growth of WSL was allometric.

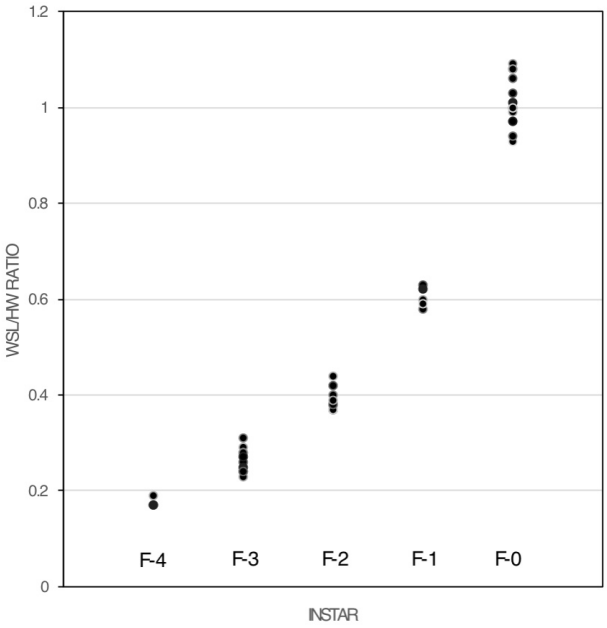

Figure2. Metathoracic wing sheath length (WSL)/ head width (HW) ratios for the last five instars of *Neurocordulia yamaskanensis* in Wisconsin.

ure 3a; Table 2). However, for 21% of our F-0 specimens, the tips of LSS9 extended rearward slightly further than the tips of the PP by a mean distance of 0.1 mm. One F-0 exuvia had LSS9 and PP tips that extended rearward the same distance. Because the key to *Neurocordulia* in Needham et al. (2014) uses "lateral spines of abdominal segment 9 extending backward beyond tips of paraprocts" (p. 385) as the primary character state for distinguishing nymphs of *N. yamaskanensis* from those of *N. obsoleta* (Umber Shadowdragon), about one fifth of F-0 nymphs and exuviae of *N. yamaskanensis* would be misdetermined as *N. obsoleta*.

Further, using this couplet to identify younger nymphs would not have reliably led to correct determinations. For F-1 nymphs, the tips of the LSS9 extended beyond the tips of the PP on four of five specimens by a mean distance of 0.18 mm (Figure 3b; Table 2); the single exception was an F-1 nymph with LSS9 and PP tips that extended rearward the same distance. All nymphs in instars F-2, F-3, and F-4 also had tips of LSS9 that extended beyond the tips of the PP by at least 0.1 mm, with means that ranged from 0.24 mm to 0.34 mm (Table 2). Therefore, all examined nymphs of *N. yamaskanensis* that were not full grown (N = 30; Table 1) would, with only a single exception, have been determined as *N. obsoleta* using the most recent and widely used key to the genus (Needham et al., 2014). Unsurprisingly, DuBois et al. (2014) reported that instars F-2 and F-3 of *N. yamaskanensis* had been misdetermined as *N. obsoleta* based on LSS9 tips that extended rearward well beyond the tips of the PP.

Conclusions and Recommendations

The lengths of LSS9 of *N. yamaskanensis*, which are used as diagnostic characters to identify F-0 nymphs, exhibit allometric growth rates through earlier instars that precludes their use in identifying them. Other characters should be sought that will distinguish partly grown nymphs of *N. yamaskanensis* and *N. obsoleta*. Until that is

Table 2. Means and ranges of hind wing sheath length (WSL)/head width (HW) ratios, and distances between the tips of the lateral spines on abdominal segment 9 (LSS9) and the tips of the paraprocts (PP) for five instars of *Neurocordulia yamaskanensis* in Wisconsin (all measurements in mm).

Instar	Mean WSL/HW ratio (range)	Distance between tips of LSS9 and PP [mean (range); number in group]	
		PP > LSS9	LSS9 ≥ PP
F-0	1.01 (0.93 - 1.08)	[0.11 (0.05 - 0.3); 10]	[0.07 (0 - 0.1); 4]
F-1	0.60 (0.58 - 0.63)		[0.18 (0 - 0.4); 5]
F-2	0.39 (0.37 - 0.44)		[0.24 (0.1 - 0.4); 9]
F-3	0.27 (0.23 - 0.31)		[0.34 (0.2 - 0.5); 12]
F-4	0.18 (0.17 - 0.19)		[0.25 (0.2 - 0.3); 4]

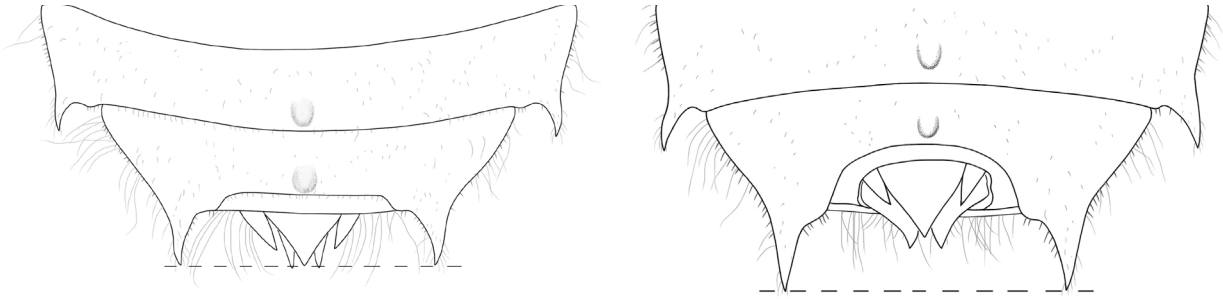

Figure 3. Abdomen tips (segments 8-10) of an F-0 nymph (upper) and an F-1 nymph (lower) of *Neurocordulia yamaskanensis* showing the lateral spines on S8 and S9 and the terminal appendages (paraprocts are the pair of appendages extending furthest rearward). Dashed lines mark the rearward extension of the tips of the S9 lateral spines, which can be compared to the positions of the tips of the paraprocts.

accomplished, currently used key couplets should not be applied to nymphs younger than F-0, and future keys should explicitly state the limitations of the relevant couplets. Further, because of some variation in the lengths of LSS9, about 20% of F-0 *N. yamaskanensis* also will not be correctly determined using current couplets. Because the lengths and dimensions of lateral spines are frequently used as diagnostic characters to identify many species and genera of Anisoptera, the ontogenic stability of these spines on relevant groups should be examined to determine their applicability for identifying nymphs in instars younger than F-0.

Acknowledgments

Funding for RD was provided by the Bureau of Natural Heritage Conservation of the Wisconsin Department of Natural Resources. Illustrations were done by KT.

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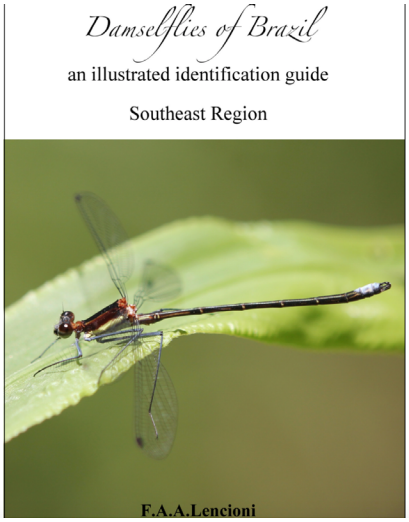
New Book Announcement: Damselflies of Brazil 2nd Edition, by F.A.A. Lencioni

Damelflies of Brazil: an illustrated identification guide to the southeast region. Frederico A.A. Lencioni. 2017. E-book, 559 pp. $100 USD. To order, request an invoice from the author at <https://zygoptera.bio.br/want-to-buy/>.

Volume 1 of the 2nd edition of "Damselflies of Brazil" has been released, containing all 159 species of Zygoptera with occurrences in the southeastern region of Brazil. The guide is offered as an e-book (PDF). It includes keys to families and genera, etymology for all genera and species, diagnostic illustrations for all species, and live photos of almost 50% of the species. The second volume in this series will address damselflies at the junction of the south, west-central, and northeast regions of Brazil, and the third volume will cover the North region.



Thank You to All of Our 2017 Argia Contributors!

Thanks to our contributors, it was another great year for Argia, filled with thrills, chills, and occasional spills in the world of odonates. This publication wouldn't be possible without the many DSA members who not only live, work, or play among odonates, but also take the extra time needed to jot down an essay, research an article, or share a photo. Everyone has something to contribute as we pursue our different levels of obsession with Odonata. If you have never contributed before but enjoy reading Argia, I urge you to take a look at your field notes and consider adding your own bit of knowledge to an Argia issue in 2018.

Celeste A. Searles Mazzacano, Editor in Chief.

Cultural Odonatology

DSA members are as diverse as the insect order we all love; we approach Odonata as scientists, educators, naturalists, artists, poets, photographers, essayists, bloggers, and more, with many wearing several of these hats. Cultural Odonatology focuses on different aspects of the human relationship with odonates, showcasing dragonflies in art, architecture, literature, and legend, and may contain original works or discussions of odonates in existing works. If you would like to contribute to this feature, contact the Editor at <editor@dragonflysocietyamericas.org>.

In this instalment, Bryan Pfeiffer shows us that even in the depths of the dragonfly-less doldrums of winter, we can still find the odonates of our dreams.

Dragonfly Dreams, by Bryan Pfeiffer <bryan.pfeiffer@uvm.edu>

While riding my bicycle across a bridge over the Winooski River here in Vermont, I hit the brakes for the greatest dragonfly swarm I had ever encountered. And from that swarm, it soon began to rain *Ophiogomphus* (Snaketails).

Ophios dropped into a nearby cornfield, into the river, and onto the bridge around me. Best of all, the fallen odes seemed fine: they would soon lift off to rejoin the swarm. Even better, they were all *Ophiogomphus howei* (Pygmy Snaketail), one of the most compelling odes on the continent. From the bridge, I netted and photographed them with joy and ease.

Then I woke up. Yet another dragonfly dream.

The only odd thing about the *O. howei* dream was that it featured an actual species. I usually dream of mythical insects.

Take the small, orange dragonfly I dreamed up one night. Its size, behavior, habitat and general appearance added up to *Perithemis tenera* (Eastern Amberwing)—except for its thorax, which was marked like that of an *Aeshna* species (Mosaic Darners).

I only wish I had photographic recall of my dreams. With a record shot of that *Perithemis*, I'd probably have an actual binomial for this crazy dragonfly. For my purposes here (and my Photoshopped rendition) we'll go with simplicity: *Perithemis juncea* (Sedge Amberwing). It perched in plain view at the tip of an emergent stick at the edge of a small mesotrophic pond (Figure 1).

As I recall, in the dream, everything about my encounter with this dragonfly seemed perfectly normal, which is too bad. I mean, if I'm going to the trouble of dreaming up some bizarre dragonfly, at the very least I'd like the privilege of discovering and describing a new species. (I think I'll seek "dream-improvement counseling" for this.)

Another dragonfly dream was far more affecting. At the perimeter of a woodland pond, very much like a vernal pool, I noticed an odd, warm, reddish blur. As I approached, I discovered what can only (in the real world) be described as a half-dozen or so male *Calopteryx maculata* (Ebony Jewelwing)—except that instead of emerald green they were a shocking burgundy.

In the dream, everything about this ode, except for its color and habitat, was pure *Calopteryx*—oh, and except for the glow. Even more so than the real thing, these *Calopteryx* seemed to be generating their own electric burgundy light—bioluminescent as they perched and danced at the pond edge. If you know *Enallagma dubium* (Burgundy Bluet), itself an arresting damselfly, you still don't know my dream insect. Mine made *E. dubium* appear lifeless and boring by comparison. I shall nevertheless call this dream odonate *Calopteryx dubium* (Burgundy Jewelwing) (Figure 2).

It's been many years since I've had a dragonfly dream. (I did once dream up a butterfly by the name of Marine Sulfur [*Colias maratimus*], which looked like a genuine *Colias* except for shocking aquamarine markings where the real things [like *C. interior*] show pink.)

Figure 1. Fantastic and phantasmagoric ode found only in Bryan's dreams: the Sedge Amberwing (*Perithemis juncea*).

Figure 2. The truly impossible Burgundy Jewelwing (*Calopteryx dubium*) perches in the dreamscape.

My aspiration now is to combine a dragonfly dream with a flying dream. As I am airborne, I'd be swinging my favorite 18-inch net. After all, how else would I land those *Somatochlora erpetogomphusi*?

Does anybody else out there have dragonfly dreams???

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 <editor@dragonflysocietyamericas.org>. Photographs to illustrate the stirring tale are encouraged. Whether you are discovering odonates this year 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 <editor@dragonflysocietyamericas.org>, and include a short note describing the photo, location, and event.

Would You Like to See Any New Features in Argia?

Argia is of, by, and for the DSA membership. I am always striving to make Argia even better than it is today, so at the close of each year I like to ask our readers if they have ideas for new features for the journal. I can't promise that all suggestions will be instituted, but you can send your ideas for new features and/or feedback about existing aspects of Argia to me at <editor@dragonflysocietyamericas.org>. Thanks!

Celeste A. Searles Mazzacano, Editor in Chief

ARGIA and BAO Submission Guidelines

All materials must be submitted digitally via e-mail or an internet file sharing service (i.e., Dropbox, GoogleDrive, TransferBigFiles, or similar service). If digital submissions are not possible, contact the Editor before sending anything. Material for ARGIA and BAO should be sent to the Editors at <editor@dragonflysocietyamericas.org>. Authors should expect to receive an e-mail confirming receipt of submissions within five business days.

Articles

All articles and notes should be submitted in Word, Pages, or Rich Text Format (RTF), without embedded figures, tables, or captions. All photos and figures must be submitted as separate files (see Figures below). Only minimal formatting of each article 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, Pages, or Rich Text Format document. Articles may be edited if needed for clarity, grammar, and/or space.

Begin the article with title, author name(s), and contact information (including e-mail for primary author) 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. The first time each species is mentioned in the article, always give both the scientific name as well as the official common name (where one has been assigned) in parentheses. Subsequent mention of the same species may be done using scientific or common name only, as the author prefers. Literature should be referenced in the article text using author names, not numbers (i.e., "Carlos and Young, 2009; Quill et al., 2011").

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 or JPG files with a **minimum of 300 ppi** at the intended print size. If you are unsure about the final print size, keep in mind that oversized 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 Editor 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) can be submitted 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 unsatisfactory. When charts and graphs are generated in Excel or Numbers, please submit the file 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 or Pages documents or as spreadsheets in Excel or Numbers. If Excel or Numbers is used, place each table on a separate worksheet and name each worksheet appropriately (e.g. "Table 1", "Table 2", etc.).

The Dragonfly Society Of The Americas

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Journals Published By The Society

Argia, the quarterly news journal of the DSA, is devoted to non-technical papers and news items relating to nearly every aspect of the study of Odonata and the people who are interested in them. The Editor especially welcomes reports of studies in progress, news of forthcoming meetings, commentaries on species, habitat conservation, noteworthy occurrences, personal news items, accounts of meetings and collecting trips, and reviews of technical and non-technical publications. 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 DSA includes a digital subscription to BAO.

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 and BAO. Dues for individuals in the US, Canada, or Latin America are $15 US for regular memberships (including non-North Americans), institutions, or contributing memberships; $5 US or more can be added for sustaining memberships. Dues are payable annually on or before 1 March of membership year. Membership dues can be paid online via credit card; see <http://odonatacentral.org/index.php/PageAction.get/Name/DSA_Membership>. Membership forms can also be downloaded and mailed with a check to The Dragonfly Society of the Americas, Inc., Attn: Cynthia McKee, Treasurer, 605 9th Avenue, Ottawa, Illinois 61350-4119. For more information on joining DSA, visit <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)** *Pantala flavescens* (Wandering Glider), Mason Neck West, Fairfax County, Virginia, 8 September 2017. Photo by Fred Siskind. **(lower)** Slender Spreadwing (*Lestes rectangularis*), Amboy Marsh Nature Preserve, Lee County, Illinois, 14 August 2014. Photo by Dick Todd.