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2018 DSA Annual Meeting 13–15 July in Finland, Minnesota

Mitch Haag <mitchell.haag@threeriversparks.org>

Greetings from Minnesota, my fellow dragonfly enthusiasts! The Minnesota Dragonfly Society (MDS) is excited to host this year's annual DSA meeting at Wolf Ridge Environmental Learning Center (<<https://wolf-ridge.org/>>) located in Finland, Minnesota (north of Duluth). We want to send out an invitation to all who appreciate, marvel, and obsess over the Odonata to come join us in the North Woods where the peatlands are plenty and the lutefisk is commonly served (well, OK, that's gross...).

Minnesota is home to 150 odonate species, and the North Woods offer some of the best intact peatlands in the lower 48 states, including raised bogs, patterned peatlands, ribbed fens, bog lakes, and calcareous fens. This landscape sets the stage for the highest odonate diversity in Minnesota including 11 species of *Somatochlora* (striped emeralds), most notably *S. brevicincta* (Quebec Emerald), and 15 species of darners including *Aeshna subarctica* (Subarctic Darner), *A. sitchensis* (Zig-zag Darner), and *Boyeria grafiana* (Ocellated Darner).



Helicopter view of Red Lake Peatland Scientific & Natural Area, the largest and most diversely patterned peatland in the U.S. Photo by Ami Thompson.

The habitats and breath-taking views of Lake Superior will not disappoint. We will offer pre-meeting field trips in the Minneapolis area on 10–11 July. Another pre-meeting field trip is scheduled for Thursday 12 July at Wolf Ridge in Finland. The main meeting will take place on 13–15 July. We will start with a field trip on Friday 13 July targeting the Quebec Emerald (*Somatochlora brevicincta*). On Saturday 14 July we will have the business meeting and presentations during the day, followed by a banquet and silent auction. On Sunday 15 July there will be two field trips to choose from: the butterflies, odonates, and birds of the Sax-Zim Bog (van transportation from Wolf Ridge will be available); or a trip led by Kurt Mead to discover the waterfalls and odonates of the North Shore. Post-meeting trips are scheduled for 16–17 July Wolf Ridge. All field trips will include easy to difficult options.

We have two primary lodging options for the main meeting:

1) On site: For those who prefer a great location, inexpensive housing, and convenience, we offer on-site lodging with meals in the dorm at Wolf Ridge Environmental Learning Center, where the main meeting will take place.

2) Offsite: For those who prefer traditional hotel accommodations and do not mind staying offsite, we have reserved a block of rooms at the AmericInn in Silver Bay, 16 miles from Wolf Ridge (about a 25 minute drive).

There are also other hotels, bed and breakfasts, and campgrounds nearby, but keep in mind that this is tourist season in northern Minnesota, so you should make your

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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	12–17 July 2018	Finland, Minnesota	M. Haag <Mitchell.Haag@threeriversparks.org>
NE DSA 2018	2–5 August 2018	Hampden County, Mass.	Joshua Rose <opihi@mindspring.com>

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reservations early.

With numerous species of *Somatochlora* to be found, amazing habitats to be explored, and great company from folks near and far, it would truly be flat-out wrong to miss this year's DSA annual meeting in the Land of 10,000 Lakes!

Abstracts for the presentation day are being accepted, on any topic consistent with the DSA mission to advance "discovery,

conservation and knowledge of Odonata through observation, collection, research, publication, and education." Presentations are 20 minutes (including time for questions) and are not limited to peer-reviewed, published research. Shorter presentations are welcome; requests for longer talks will be considered. If you are interested in giving a presentation, please see the Call for Abstracts <<https://sites.google.com/udel.edu/dsa2018/call-for-abstracts>>. For more information and to register, please go to <<https://sites.google.com/udel.edu/dsa2018/home>>. 

DSA Northeast Regional Meeting, 2–5 August, Hampden County, Massachusetts

Joshua S. Rose <opihi@mindspring.com>

The DSA's northeast regional meeting for 2018 will take place August 2–5 in Hampden County, Massachusetts (possibly straying into one or more adjacent counties). This time frame should give us a shot at the three local species of *Stylurus* (hanging clubtails): *S. spiniceps* (Arrow Clubtail), *S. scudderi*, (Zebra Clubtail), and hopefully *S. amnicola* (Riverine Clubtail). There should also be a variety of *Aesbna* (darner) species. The county rather shockingly has not one single *Somatochlora* (striped emerald) record on its OdonataCentral checklist, but we should be able to do something about that! Other possible targets for the season and area include *Boyeria grafiana* (Ocellated Darner), *Enallagma carunculatum* (Tule Bluet), and perhaps an extreme long-shot possibility of *Cordulegaster erronea* (Tiger Spiketail). Our main field site is the Fannie Stebbins Refuge in Longmeadow, with the Norcross Wildlife Sanctuary in Monson/Wales also on the agenda, and other destinations being negotiated.

The official hotel is Holiday Inn Express in Ludlow, and is conveniently located right off the Mass Pike, (413-589-9300;



Williamson's Emerald (*Somatochlora williamsoni*), Amherst, Hampshire County, Massachusetts, 28 July 2013. Photo by Joshua Rose.



Zebra Clubtail (*Stylurus scudderi*), Amherst, Hampshire County, Massachusetts, 23 July 2013. Photo by Joshua Rose.

<<https://www.ihg.com/holidayinnexpress/hotels/us/en/ludlow/bedll/hoteldetail>>). They are offering a group rate through 2 July; after which prices rise by \$20–\$40 per room. The manager also noted that the local military base has something happening that weekend and rooms are liable to run short, so she suggested **not** putting off booking your room until the last minute!

A meeting website has not been set up yet, but watch your local odonate-oriented e-mail list, FaceBook discussion group, or the "other meetings" page of Odonata Central, and hopefully it will appear in those venues in the near future.

Hope to see you in August!



Netting a Larva of *Gomphaeschna furcillata* (Harlequin Darner) for the First Time in 30 Years of Collecting

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

On 13 August 2017, BM and his wife, Lyne, went on a field trip to collect dragonfly larvae. They drove to the municipality of Mulgrave-and-Derry in Papineau County, province of Quebec, Canada. This area is situated north of the town of Buckingham, which is now officially the eastern part of the city of Gatineau (population 300,000).

After parking the car on the roadside, they spotted a dark, sandy pool, mostly hidden by branches of shrubs but somewhat linked to an intermittent forest brooklet extending quite a distance from the road. This aquatic habitat actually runs under the culvert on each side of the road. The presence or absence of water therein is regulated by melting snow or rain. This brooklet is thus active when it rains and stagnant or dry during long periods of drought. However, the pool where the *Gomphaeschna* larva was found always retains some water that harbors a variety of invertebrates, even in periods of drought.

Among the larvae collected in the habitat, they spotted an immature aeshnid with unusually long antennae wriggling in BM's aquatic net. We were subsequently able to establish that we had found a young larva of *Gomphaeschna furcillata* (Harlequin Darner). The specimen is being kept alive in a small container and fed with mostly mosquito larvae in BM's home. Growth is slow, however, and no larval skin has been seen in the container. The *Gomphaeschna* larva either walks on the bottom of the container or climbs on a substrate, a stick, often motionless, head down.



Rearing tank for Harlequin Darner (*Gomphaeschna furcillata*) larva. Note mosquito larvae in water column and larva clinging head-down at the lower left side of the vertical stick. Photo by Benoit Ménard.



Harlequin Darner (*Gomphaeschna furcillata*) larva. Photo by Benoit Ménard.

In our field trips over the past 30 years, we had never netted a *Gomphaeschna* larva, in spite of exploring many habitats mentioned in odonatological literature pertinent to this aeshnid species. In this brooklet, with its pools, BM and his wife have also collected *Epiaeschna heros* (Swamp Darner; four specimens) and a number of nymphs of *Somatochlora walsbii* (Brush-tipped Emerald), *S. elongata* (Ski-tipped Emerald), and *S. kennedyi* (Kennedy's Emerald). In one instance, they netted tiny fish and crayfish, and also Coleoptera (beetles). The odonate larvae were brought to BM's home, alive and put into containers. A number of them have emerged to enable us to verify which species BM and his wife have collected.

In 2018, we shall return to the site of our "miraculous" discovery in hopes of netting other *Gomphaeschna* larvae. Adults are still to this day uncommonly observed and collected in the province of Quebec, although recently, the number of records and geographical extensions for the province show a modest increase.



Celithemis elisa (Calico Pennant) Emergence in the Finger Lakes Region of New York State

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Over the last 13 years we have closely monitored the emergence of a population of *Celithemis elisa* (Hagen, 1821) in our farm pond. While the pond is small, the population of this *Celithemis* species is quite large, often thousands per year, and definitely worthy of study.

The pond is fairly new (built in 2000), D-shaped and 15 feet deep with very steep sides. It is spring-fed and clear, with a substrate of the alga *Chara* and a large patch of cattails along one side. Other vegetation consists of small patches of cattail, rushes, and sedges. The dike top is mowed regularly and the pond is faced by forest on two sides with fallow low brush on the other two.

Celithemis elisa (Calico Pennant) found and colonized the pond when it was new and quickly burgeoned to the point that we decided to study them starting in 2005. Each season we perform daily point counts of teneral during the morning hours, usually around 7 a.m., rain or shine. Notes on weather and any behavioral observations are made every day. To adhere to a standard protocol our counts take place only once per day, even though *C. elisa* continues to emerge well into the day and at night.

The normal pattern we have come to expect is that of a typical spring species with a synchronized mass emergence during the

Table 1. Summary of *Celithemis elisa* emergence activity over 13 years. Numbers are derived from a single daily circumambulation of study pond between 7 and 8 a.m., rain or shine.

Year	Season Total	Peak Period	Peak Period % of Total	Emergence Period Length
2005	2,455	7-11 June	83% (2,028)	>62 Days
2006	10,944	5-9 June	47% (5,169)	63 Days
2007	6,497	1-6 June	75% (4,892)	61 Days
2008	8,237	8-12 June	76% (6,244)	64 Days
2009	1,505	6-10 June	15% (229)	68 Days
2010	642	31 May-4 June	43% (277)	54 Days
2011	1,993	1-7 June	58% (1,152)	51 Days
2012	982	27-31 May	57% (556)	54 Days
2013	3,975	31 May-3 June	63% (2,532)	56 Days
2014	615	3-4 June	20% (127)	51Days
2015	1,352	28-31 May	65% (890)	49 Days
2016	1,226	3-5 June	70% (861)	51 Days
2017	4,218	9-23 June	82% (3743)	55 Days

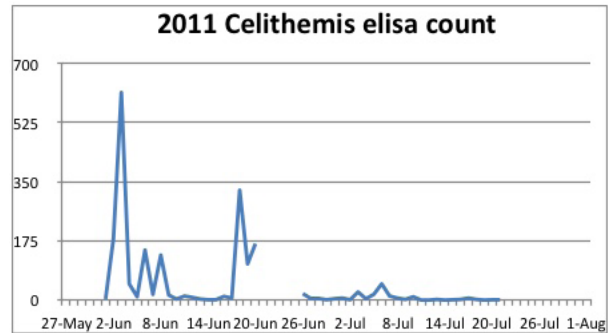


Figure 1. A typical emergence pattern for *Celithemis elisa* (Calico Pennant) from 2011. Note large primary peak and smaller subsequent surges.

first few days of their season, usually around the first week of June. These would be larvae that have overwintered in late stage development, F-0 or F-1, and are eager to become adults.

The primary surge lasts an average of five days then drops to small numbers punctuated by minor surges for another two weeks or so (Figure 1). Emergence then continues in single or



Figure 2. A well-developed teneral *C. elisa* at 1:36 am on 10 June 2017; it was gone before daybreak.

double digits for the rest of the emergence period. Because the breeding season is quite long, lasting well into August, it is supposed that the larvae from the secondary surges are from adults who bred later in the previous season. These larvae overwintered in earlier stages, and resumed development in the spring when warm temperature and photoperiod allowed.

Table 1 depicts the number of individual tenerals counted during our daily point counts and the early period of intense synchronized emergence. The percentage of the total that emerges during these few days reveals the impact of the initial surge over the extended emergence period; normally half the entire population emerges in this peak period.

As with most taxa, the total number counted varies from year to year and so does the pattern. Occasionally they surprise us; for example, 2009 and 2010 were quite flat, with only small synchronized surges at the beginning of the season and disappointingly low numbers for the duration. In 2017 there was a very long primary surge that lasted an entire two weeks—they never took a break.

Weather conditions have run the gamut over the length of our study. During the initial surges it has been hot, cold, windy, wet, or dry, yet the biological drive to emerge persists once the initial trigger has tripped; nothing stops them. After that initial surge, they become more flexible so cold weather or rain will have an adverse effect and slow them down.

After the first teneral is seen it is about 10 days before we see the first mature adult. Very quickly, if not that very day, pairing and oviposition is intense all day long. It is not uncommon to see dozens of pairs madly ovipositing all over the pond for several weeks, contributing to the early surge for the next season. This too slows as the season progresses. Two areas of behavior are of increasing interest to us: night emergence and clustering.



Figure 4. A teneral *C. elisa* and his exuvia.



Figure 3. Five teneral *C. elisa* clinging to a communal patch of vegetation on 9 June 2017.

Night emergence

While it is normal to witness maiden flights and larvae in the various stages of emergence in the morning and even throughout the day, some larvae choose to emerge in darkness and leave before daybreak. This can begin quite early in the night, just a few hours past sunset, and continues at a varied rate throughout the night. Several times tenerals were observed completely out of their exuviae and inflating their wings as early as 12 a.m. Most of these night-emerging individuals complete their transformation during the night and are gone by early morning the next day (Figure 2). Thus, while hundreds have been seen to emerge at night, they are not present in the morning and do not make it into the daily point count.

Emerging at night may be a survival strategy against bird predation, but there are other predators that take advantage of the abundance. Ants and spiders in particular have been seen consuming helpless tenerals at night. Oddly, our bullfrogs seem oblivious to their presence and ignore them (so far).

Clustering

There appears to be some sort of cohesion trigger that incites many larvae to cluster together and emerge very close to one another in tight groups. Often a single patch of two or three sedges may have 10-15 individuals while a perfectly good similar patch nearby has none. The rate at which individuals within these groups emerge varies. In a single cluster there may be several that are ready for their maiden flight, ones barely out of the

water, and some at every stage in between. Yet, in another cluster nearby, they all may be in the same stage (Figure 3).

Perhaps there is a chemical cue that acts as a cohort aggregation trigger. This phenomenon takes place with some other species, so there is much room for study on this topic. Our own work with this species will continue, especially on night emergence. Needless to say they are a delightful species to study. 

Some Looks Into the University of Michigan Museum of Zoology (UMMZ) Past Upon My Retirement

Mark F. O'Brien, Ann Arbor, Michigan <mfobrien@gmail.com>

At the end of 2017, I retired from the University of Michigan, having been the Insect Division Collection Manager at the Museum of Zoology (UMMZ) since May 1981. Spending over 36 years at one place is quite a feat these days, and while it seems like only yesterday that I started, I was ready for a change, and nothing changes one like retirement.

When I started in 1981 at the UMMZ as a Museum Technician, my office had a telephone and an electric typewriter that was probably as old as I was. In 1983, the UMMZ purchased several Victor 9000 computers that were mostly used for word processing. By 1987, I had an IBM PC in my office, soon replaced by a Macintosh Plus computer. By 1994 we were finally wired to the internet, and we had a UMMZ web page in 1996. Our first specimen-level databases in Filemaker started in the late 1990s, and the data were imported into SPECIFY in 2016. While the internet can be a time-waster, I was able to do things in the collection that were nearly impossible before. Authority files, species lists, mapping, data management, file sharing, and bibliographic searches changed how I did my job.

In my early years at the UMMZ, I spent most of my time physically improving the collection, ameliorating years of inadequate collection management and benign neglect in the groups that were not Orthoptera (grasshoppers, katydids, and crickets). I also had the pleasure of knowing curators Theodore H. Hubbell, Irving J. Cantrall, and Richard D. Alexander—all orthopterists with different interests. One curator, Barry O'Connor, has been at the UMMZ only a bit longer than I, and his encyclopedic knowledge of Acari (mites) is awesome. I recall sending him bee specimens with mites on them while I was an undergrad at SUNY College of Environmental Science and Forestry, and he was a doctoral student at Cornell.

I met Leonora K. Gloyd ("Dolly") in 1981, and my first impression of her was that she was an odd old lady who probably didn't care for the young whippersnapper mucking around in



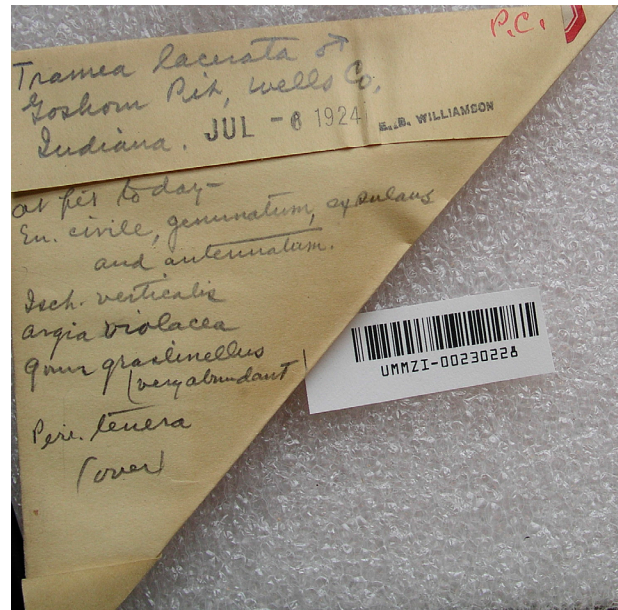
Upper: a plethora of cigar boxes held specimens from around the world, most still in their field triangles. By 2013, such specimens were in drawers in the collection, with about 1/3 transferred to clear mylar envelopes with label data printed on a 3x5 card. Lower: lack of space meant drawers were sitting outside of the insect cabinets. Photos by Mark F. O'Brien, circa 1987.

her part of the collection. At that time, Dolly practically lived there, and the dishevelment in the Odonata collection was partly due to her unique ways, and partly because there was no room for expansion. Boxes of reprints and specimens were piled on top of the cabinets, and I did not dare go messing around with anything in the Odonata for fear of her admonishing me with “Mr. Williamson would not have done it that way.” At the time, my interest was in Hymenoptera (wasps and bees), especially in solitary wasps (Sphecoidea and Pompilidae), and I concentrated on improving the curation and expansion of those groups as well as the rest of the pinned collection. Whenever a loan of Odonata went out, Dolly typed up pages that listed every specimen that was sent. After a while, she acquiesced to me being the Collection Manager, and my brevity in the loan forms probably irritated her. While Dolly had her unique ways, it was through her that I met so many of the interesting odonatologists who visited our collection. She was an encouraging voice to anyone interested in dragonflies.

It wasn't until 1996 that I became really interested in studying Odonata. By then, we had modernized our Ruthven Building collection space and added many new cabinets and thousands of drawers, through a National Science Foundation Collections Improvement Grant. We relocated the Odonata to a separate room, rehousing the specimens in new drawers and cabinets. In addition, we started transferring many thousands of Odonata specimens from field envelopes to modern clear sleeves with 3x5 inch cards. Dolly Gloyd had left Ann Arbor around 1990, and she died in Texas in 1993. She never got to see the collection upgrades, and yet, in 2017, I was still dealing with her legacy. I am still amazed at her dogged acquisition of specimens from com-



Compacted storage of entomological wet collections, Research Museums Center, 2012. Photo by Mark F. O'Brien.



Example of one of E.B. Williamson's paper triangles with a story to be told. Photo circa 2015, by Mark F. O'Brien.

mercial collectors, her type-written labels on paper triangles, and her voluminous correspondence with all other odonatologists. E.B. Williamson may have been responsible for the basis of the Odonata collection that came to the UMMZ, but Dolly was responsible for its continued growth.

In 1996, I started a study of the Odonata of the Huron Mountain Club—60 square miles of private land in Marquette County, Michigan. I had previously studied the wasp fauna over many years there, and that was my initiation into the world of dragonflies, with help from colleagues Michael Kielb and Ethan Bright. In 2003, we published the results of our studies in the Huron Mountains in the *Bulletin of American Odonatology* (Vol. 7, No. 1). It was the first comprehensive survey of any insect group in the Upper Peninsula of Michigan. By 1997, we started the Michigan Odonata Survey (MOS), and my intent in retirement is to finally publish the results of 20+ years of data accumulation and addition of many thousands of vouchers from the MOS collectors.

In 2013, we moved our wet collections (specimens in ethanol) into what is now called the Research Museums Center at 3600 Varsity Drive, about five miles from the Ruthven Museums Building on the main UM Campus. That was a significant upgrade in collection space for our specimens in vials and jars, and made the Odonata nymphs more accessible for researchers. Then, in 2016, the dry UMMZ collections were also moved to new space in the RMC. Two tiers of six-foot compacted cabinets (12 feet high total) would never have worked for Dolly Gloyd, and while not optimal for me either, the collections are housed under the best conditions, with specimens and related materials in shared space with the other UMMZ divisions.

Two students working for me from 2015–2016 cataloged all of our North American Odonata specimens. That data will be sent to iDigBio (Integrated Digitized Biocollections; <idigbio.org>), at some point in the near future. In total, our North American Odonata holdings are about 80,000 specimens. I suspect that the rest of the Odonata collection (including unidentified specimens) will top 150,000 specimens. My replacement at the UMMZ will have to deal with that now.

Over the years, I have made many great contacts in the museum community. As long as they are supported, the collections will

outlive us, and as I reflect over the years that I worked at the UMMZ, I have to say I think I did a pretty decent job as the collection manager. The collections are in good shape, many specimens have been cataloged, and as in any research museum, there will always be plenty of work for my replacement.

Now that I am retired, I will be doing freelance work on databasing specimens, editing the Michigan Entomological Society Newsletter, and working on my MOS opus. At 61, I still have a lot in the tank, and hope to continue to do freelance work on entomological projects and as a bioinformatics specialist. 🦋

Neotropical Frontier—Distributional Changes Along the Arizona and Mexico Border

Justin Jones <juniperhops76@yahoo.com>, **Pierre Deviche** <deviche@asu.edu>, **Richard Bailowitz** <raberg2@q.com>, and **Douglas Danforth** <dougofbis@gmail.com>

Considerable evidence demonstrates recent changes in the distribution of multiple odonate species (e.g., Swaegers et al., 2013; Powney et al., 2015; Ball-Damerow et al., 2015). The factors that contribute to range expansions or retractions generally remain poorly understood, but are thought to be of an intrinsic and/or extrinsic nature (Angert et al., 2011). Intrinsic factors encompass the species' rate of reproduction and dispersal as well as its dispersal ability, which itself involves a role for structural factors such as the wing aspect ratio (Swaegers et al., 2014). Extrinsic factors include the presence of suitable habitat, dispersal conditions, and the ability to co-exist with predators (Siepielski and Beaulieu, 2017). In addition, species may adjust to novel environmental conditions through phenotypic changes, such as an increase in body size with increasing latitude (*Erythromma viridulum*: Hassall et al., 2014) and better mechanisms of defense against predators (*Enallagma* spp.: Siepielski and Beaulieu, 2017). However, these adjustments can be impaired by exposure to anthropogenic influences such as environmental contaminants (e.g., pesticides in *Coenagrion scitulum*: Dinh et al., 2016). Finally, global climate changes can influence species distributions and abundances (Bush et al., 2014; Corser et al., 2015), and there is concern for the fact that loss of habitat resulting from these changes, combined in some cases with low dispersal ability, will affect species negatively (Bush et al., 2014).

Identifying range shifts, as well as factors that account for the species-specific manner in which these shifts take place, warrants research because it has important biological implications. Indeed, range shifts can foster novel species interactions and predator-prey relationships that have the potential to affect biodiversity and reshape community structures (Fitt et al., 2017). As a contribution to these questions, here we describe changes in distribution of four species in Arizona, with emphasis on changes taking place in 2017: two Zygoptera (Cerulean Dancer,



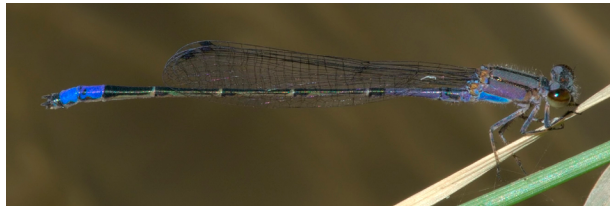
Cerulean Dancer (*Argia anceps*). Photo by Pierre Deviche.

Argia anceps and Neotropical Bluet, *Enallagma novaehispaniae*) and two Anisoptera (Straight-tipped Ringtail, *Erpetogomphus elaps* and Carmine Skimmer, *Orthemis discolor*).

Cerulean Dancer (*Argia anceps*) was first reported in Arizona on 28 March 2013 along the middle San Pedro River near Benson in Cochise County, where it was photographed and a specimen was collected (Danforth et al., 2013). Due to the similarity between this species and Sierra Madre Dancer (*A. lacrimans*), this discovery led to a review of past observations and it was found that the species had previously been photographed on 3 September 2012 in Sycamore Canyon (Danforth et al., 2013). In 2013, *A. anceps* was found at three additional locations and has now been recorded at more than 20 locations in the state. In the past few years, observers noted tandem and ovipositing pairs, as well as relatively high concentrations of individuals (e.g., daily counts of over 20 individuals along Sonoita Creek near Patagonia in Santa Cruz County). The rapid range expansion of *A. anceps* in the past few years suggests that it will continue and the species will be discovered at yet other new locations in the state.

The Neotropical Bluet (*Enallagma novaehispaniae*) occupies Sonoran drainages close to the Arizona border and so has been on the radar of Arizona odonatists for many years (Bailowitz et al., 2015). The species was first discovered in the state on 16

November 2010 near Painted Rock Dam in Maricopa County, where two individuals were found flying (Bailowitz, 2010). It then remained undetected until 2015, when an individual was photographed along Sonoita Creek. In 2016, which proved a banner year for that species, there were multiple observations in several new localities and breeding pairs were observed (Deviche, 2016). A factor that may have contributed to this rapid expansion was the remnants of Hurricane Newton, which passed through central Arizona after tracking through northern Sonora and may have carried individuals northward. The increase in number of locations and individual numbers that took place in 2016 continued well into 2017 with two sites, the Salt River near Phoenix (Maricopa County) and the Santa Cruz River near Tucson (Pima County), harboring hundreds of individuals. *E. novaehispaniae* has now been found flying year-round in the state and at some locations, it has become the most abundant *Enallagma* sp. encountered. Additional fieldwork may reveal the presence of the species in additional areas, perhaps even west to the Colorado River on the California border.



Neotropical Bluet (*Enallagma novaehispaniae*). Photo by Pierre Deviche.

The first record of Straight-tipped Ringtail (*Erpetogomphus elaps*) in Arizona and the United States was on 17 September 2008 along the Parker Canyon Schoolhouse Stream in Santa Cruz County (Danforth and Bailowitz, 2008). This species was not expected in Arizona, having been previously found only as far north as central Sonora. Continued fieldwork between 2008 and 2016 produced five additional records for the region, all in the same general area at the south end of the Huachuca Mountains. During the second half of 2017, however, multiple individuals were also observed in four locations scattered along the international border: Sycamore Canyon, Parker Canyon Schoolhouse Stream, Sonoita Creek, and along the Arroyo San Bernardino just one mile south of the international boundary in Sonora. Notably, observations at these locations extended over months, suggesting local breeding. The apparent recent range extension may reflect the effect of a particularly wet summer monsoon season, warmer than normal winter temperatures, and/or increased familiarity with the species.

Carmine Skimmer (*Orthemis discolor*) was first collected in Arizona on 22 August 1977 in Sycamore Canyon, Maricopa County (Rehn and Paulson, 2002). Although common in Sonora within 100 miles of the border, the species subsequently went unrecorded in Arizona until a single individual was found in a shady cove of Patagonia Lake, Santa Cruz County, in 2006.

The frequency of occurrences increased between 2006 and the end of 2016, with five additional individuals being recorded in the state. In 2017, the species experienced a further range expansion. Field workers encountered the skimmer between June and November in at least five locations, including two county records (Pinal and Gila counties). It is notable that no female *O. discolor* has yet been documented in Arizona. However, females are cryptic and rather similar to Roseate Skimmers (*Orthemis ferruginea*), which are numerous, raising the possibility that they are present but not detected.

The above observations suggest that the four species we discuss here have become permanent fixtures in Arizona. However, only future research will determine whether this is indeed the case. For example, Antillean Saddlebags (*Tramea insularis*) were regularly found in Arizona between 2006 and 2013 and during this period, a breeding population may have been present at Kearny Lake in Pinal County, where multiple individuals were photographed in late May and early June of 2010 and up to 30 individuals a day were observed during fall visits. Since then, however, a single individual has been observed in the state.

The future status of other species is equally equivocal. For example, the Narrow-striped Forceptail (*Aphylla protracta*) is currently found breeding at one location (near Mammoth in Pinal County). A pair in wheel was photographed at the San Bernardino National Wildlife Refuge (Cochise County) in 2008, but this event did not result in establishment of a population at that location. Harkness' Dancer (*A. harknessi*) was discovered in Arizona on 5 June 2007 along the San Francisco River near Clifton in Greenlee County (Bailowitz and Danforth, 2007); this species was also documented in 2015 and 2016. Noteworthy amongst the observations was the first documented female for the state, found at Kelvin Bridge (Pinal County) along the Gila River. Regular surveys of the Gila and San Francisco Rivers, and other drainages in the same area, may reveal permanent populations of *A. harknessi*.



Straight-tipped Ringtail (*Erpetogomphus elaps*). Photo by Justin Jones.

Overall, however, the long-term success in Arizona of *A. barknessi* and other species considered here remains for the most part unpredictable. Current models of future climate changes indicate that the southwest United States, which includes Arizona, will likely experience warmer conditions and unprecedented drought during the remainder of the 21st century (Cook et al., 2015). Odonate reproduction depends on aquatic environments and there is already ample evidence that climate changes are affecting their distribution in other regions. Thus, diversity, abundance, and distribution of odonates in Arizona in the near future will probably continue to undergo significant changes.

Literature Cited

- Angert, A.L., L.G. Crozier, L.J. Rissler, S.E. Gilman, J.J. Tewksbury, and A.J. Chunco. 2011. Do species' traits predict recent shifts at expanding range edges? *Ecology Letters* 14: 677–689.
- Bailowitz, R. 2010. *Enallagma novaehispaniae* Calvert (Neotropical Bluet), another new species for Arizona. *ARGIA* 22(4): 3.
- Bailowitz, R. and D. Danforth. 2007. *Argia barknessi* Calvert (Harkness' Dancer) new to the United States. *ARGIA* 19(2): 24–25.
- Bailowitz, R., D. Danforth, and S. Upson. 2015. A Field Guide to the Damselflies and Dragonflies of Arizona and Sonora. Nova Granada Guides, Tucson, Arizona.
- Ball-Damerow, J.E., P.T. Oboyski, and V.H. Resh. 2015. California dragonfly and damselfly (Odonata) database: temporal and spatial distribution of species records collected over the past century. *Zookeys* 67–89.
- Cook, B.I., T.R. Ault, and J.E. Smerdon. 2015. Unprecedented 21st century drought risk in the American Southwest and Central Plains. *Science Advances* 1: e1400082.
- 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* 11: 20150001.
- Danforth, D., R. Bailowitz, and P. Deviche. 2013. Cerulean Dancer, *Argia anceps*, a new species for the United States. *ARGIA* 25(2): 10–11.
- Deviche, P. 2016. Unprecedented number of Neotropical Bluets, *Enallagma novaehispaniae* Calvert, in Arizona. *ARGIA* 28(4): 32.
- Dinh, K.V., L. Janssens, L. Therry, L. Bervoets, D. Bonte, and R. Stoks. 2016. Delayed effects of chlorpyrifos across metamorphosis on dispersal-related traits in a poleward moving damselfly. *Environmental Pollution* 218: 634–643.
- Fitt, R.N. and L.T. Lancaster. 2017. Range shifting species reduce phylogenetic diversity in high latitude communities via competition. *Journal of Animal Ecology* 86: 543–555.
- Hassall, C., S. Keat, D.J. Thompson, and P.C. Watts. 2014. Bergmann's rule is maintained during a rapid range expansion in a damselfly. *Global Change Biology* 20: 475–482.
- Powney, G.D., S.S. Cham, D. Smallshire, and N.J. Isaac. 2015. Trait correlates of distribution trends in the Odonata of Britain and Ireland. *PeerJ* 3: e1410.
- Rehn, A. and D. Paulson. 2002. *Orthemis discolor* from Arizona. *ARGIA* 14(2): 11.
- Siepielski, A.M. and J.M. Beaulieu. 2017. Adaptive evolution to novel predators facilitates the evolution of damselfly species range shifts. *Evolution* 71: 974–984.
- Swaegers, J., J. Mergeay, L. Therry, D. Bonte, M.H. Larmuseau, and R. Stoks. 2014. Unravelling the effects of contemporary and historical range expansion on the distribution of genetic diversity in the damselfly *Coenagrion scitulum*. *Journal of Evolutionary Biology* 27: 748–759.
- Swaegers, J., J. Mergeay, L. Therry, M.H. Larmuseau, D. Bonte, and R. Stoks. 2013. Rapid range expansion increases genetic differentiation while causing limited reduction in genetic diversity in a damselfly. *Heredity (Edinburgh)* 111: 422–429.



Carmine Skimmer (*Orthemis discolor*). Photo by Justin Jones.

Results of New DSA Membership Categories Vote

The DSA Executive Council proposed adding a sentence to Section II, part B of the DSA bylaws to enable creation of two new membership categories. Voting took place from 15 December 2017 to 15 February 2018. The proposal passed, with 23 yes and zero no votes. The bylaws will be amended, and DSA memberships now include Life membership (single payment of \$300 US) and Sustaining Life membership (single payment of \$400 US or more).

First Confirmed Breeding Record of *Epiaeschna heros* (Swamp Darner) in Massachusetts

Peter Trull <petrull@comcast.net>

In the spring of 2016, I built a nest box for great-crested flycatchers and placed it 3 m from the ground on a pole at the edge of my yard, about 6 m from a window. My intention was to photograph food items being brought in by parents to feed young. The male started nest building on 27 May 2016, and I set up and began photographing adults feeding young on 25 June.

Over the next seven days I photographed 47 different instances of feeding. I used a Canon T2i digital camera and Canon 400mm f 5.6 lens or Canon 55-250mm zoom 4-5:6 and was able to photograph most food items as the parents brought the insects in and landed on the box before flying into the cavity. I was unable to identify all of the food items, but the majority were insects in the orders Diptera (true flies), Lepidoptera (moths and butterflies; both adults and larvae), Orthoptera (grasshoppers and crickets), and Odonata.

While photographing on 2 July, I observed a large darner in the beak of a parent flycatcher as it landed on the box roof at 2:37 pm. I photographed the specimen and after conferring with Blair Nikula, he informed me that the darner was a newly emerged Swamp Darner (*Epiaeschna heros*), a species with no known breeding sites and not previously confirmed as breeding in Massachusetts. The species ranges from New England south to Florida and west to Kansas and Texas. (Paulson, 2012). Swamp Darners have been observed in large swarms on Cape Cod in early June, presumably in migration. Their preferred breeding habitats include shallow, muddy ponds and shaded woodland streams and pools. A wetland area with these characteristics is located 150 m from my nest box, and this nearby shallow, muddy pond requires further investigation.

Acknowledgements

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Literature Cited

Paulson, D. 2012. Dragonflies and Damselflies of the East. Princeton University Press.



Flycatcher bringing prey back to the nest box. Upper: Swamp Darner (*Epiaeschna heros*). Lower: Giant Leopard Moth (*Hypercompe scribonia*). Photos by Peter Trull.

***Remartinia secreta*, First U.S. Record and Significant Range Extension, Photographed in the Path of the Proposed U.S./Mexico Border Wall**

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This article documents the first U.S. record for *Remartinia secreta* (no common name) and a significant range extension—and the impending destruction of the habit in which it was discovered. I photographed *R. secreta* in an abandoned irrigation ditch on a property of the National Butterfly Association (NABA, or National Butterfly Center as it is known locally). The center and nearby Santa Ana National Wildlife Refuge have become ground zero for the fight to stop the construction of a border wall along this stretch of the Lower Rio Grande Valley of Texas.

I am a high school science teacher with a B.S. in Biology. In December 2008, I purchased a Canon Rebel camera to catalog the biodiversity around my home town in Uvalde County, Texas. My initial focus was birds, as I was already an avid bird-watcher, and I photographed and documented avifauna around central and western Texas. On my excursions I photographed anything that interested me, including the occasional perched dragonfly or damselfly. My early photographs consisted of multiple shots of common widespread *Argia* (dancers), Variegated Meadowhawks (*Sympetrum corruptum*), and countless shots of Roseate Skimmer (*Orthemis ferruginea*).

My interest in Odonata peaked when I was asked to help a colleague, Tony Gallucci, with an Odonata survey at Big Springs Ranch in Real County. Beginning in summer 2009 I documented a number of Uvalde County records, adding many regularly occurring Lower Rio Grande Valley (LRGV) species to the county lists and documenting county records for Tawny Pennant (*Brachymesia herbida*), Chalky Spreadwing (*Lestes sigma*), Evening Skimmer (*Tholymis citrina*), Blue-faced Darner (*Coryphaeschna adnexa*), Black Pondhawk (*Erythemis attala*), Straw-colored Sylph (*Macrothemis inacuta*), and Antillean Saddlebags (*Tramea insularis*). I also photographed some notable species, although they were not county records: Pin-tailed Pondhawk (*Erythemis plebeja*), Mexican Wedgetail (*Acanthagrion quadratum*), Amelia's Threadtail (*Neoneura amelia*), Slough Amberwing (*Perithemis domitia*), and Gray-waisted Skimmer (*Cannaphila insularis*).

The discovery of these Rio Grande Valley species in my home range drove me to make my first Odonata quest to the LRGV in July 2010. I arrived at Bentsen Rio Grande State Park in Mission following the remnants of Hurricane Alex and Tropical Depression #2 that had dumped huge amounts of water on the foothills of the Sierra Madre (the drainage basin for the Rio Grande River). I was the last person out of Bentsen Rio Grande State Park before floodwaters from the weather event inundated the entire RGV basin. As a result, Bentsen, Santa Ana National



Remartinia secreta, Hidalgo County, Texas, 1 July 2017. Photo by Tripp Davenport.

Wildlife Refuge, and most of the low-lying parks around the Rio Grande were closed for almost a year, and it was not until 2011 that I returned to these areas. To date, I have amassed 5,474 photographs of 212 species of damselflies and dragonflies, including *Remartinia secreta*.

I located *R. secreta* on 1 July 2017. I had driven 4.5 hours to the LRGV, with my sights set on the National Butterfly Center gardens. A Red-mantled Skimmer (*Libellula gaigei*) had been discovered at the abandoned irrigation canal that ran through the park, providing only the 2nd record for *L. gaigei* in the U.S. (Martin Reid, 11 August 2009 and Mike Rickard, 22 June 2017). I arrived early; morning dew was still on the grass, and mosquitoes were abundant and relentless. I headed for the location where *L. gaigei* was last seen and watched patiently for 30 minutes, but no Red-mantled Skimmer appeared; only the resident Carmine Skimmer (*Orthemis discolor*) and a Three-striped Dasher (*Micrathyria didyma*) patrolled the little pond. I decided to walk down the dry abandoned irrigation ditch where I had photographed a number of LRGV specialty darners in the past, including Bar-sided Darner (*Gynacantha mexicana*), Caribbean Darner (*Triacanthagyna caribbea*), Blue-faced Darner

(*Coryphaeschna adnexa*), and Blue-spotted Comet Darner (*Anax concolor*). I soon flushed a *G. mexicana* from the low canopy. Working my way down the ditch, I saw a darner patrolling the path ahead of me at eye level; my first thought was Caribbean Darner. It flew almost to me, made a quick turn, and hung up at eye level on a small twig. I quickly snapped a couple of long-distance shots, but once I zoomed in, I knew immediately that I had something good. The abdominal pattern was unique and the thorax was unlike anything I had seen.

I took as many shots as I could from several angles. The darner was cooperative but I kept my distance. My mind was racing and grasping for species characteristics; I knew this was something different and I had to get back to my vehicle to determine what species I had just photographed. The closest odonate I could find with my limited internet access was Malachite Darner (*Remartinia luteipennis*), a species found in the uplands of south-eastern Arizona down into Argentina. However, the thoracic stripes just didn't fit the images I had; there was a notable difference between *R. luteipennis* and the darner I had just photographed. After several e-mails and calls to fellow ode enthusiasts, Troy Hibbits suggested I look at *R. secreta*, a little-known species from central Mexico and Cuba. It was a difficult task, as I found only two photographs on the web and both were from central Mexico (Aguas Calientes, Jalisco and near Tulum, Quintana Roo). After referencing these photographs, I was confident about the thoracic pattern and made the call. I submitted the records to OdonataCentral and my identification was confirmed. Unfortunately, when Martin Reid and I returned later that same day, the *Remartinia* had left its perch and was not located again.

The identification of *R. secreta* from the Lower Rio Grande Valley (Hidalgo County) of Texas extends this species' range, which previously included only central Mexico and Cuba (where the



Blue-spotted Comet Darner (*Anax concolor*) taken in the same location as *R. secreta*, 17 August 2016. Photo by Tripp Davenport.

1952 type specimen was collected). This constitutes a range extension of 385 miles northeast of the nearest confirmed location in Mexico. There is very little literature about this species (but see Novelo-Gutiérrez, 1998) and few photos exist. I located a reference for a pinned specimen from the Honduras (1978), and two sightings were listed from Belize. The type specimen literature cites "1952, *Coryphaeschna secreta*, Calvert Type male: US natn. mus., Washington, Type locality: Cuba".

Because so little is available on the habitat and behavior of this species, it is important that the LRGV be surveyed for additional specimens and perhaps larvae. The LRGV is a rich, diverse area with a variety of aquatic habitats, but whether this species is occurs regularly there or if this was a vagrant is unknown. It is my opinion that the *R. secreta* I photographed was recently emerged, and that it is moreover highly unlikely that a vagrant had blown or migrated in from over 300 miles to the south.

With the importance of this sighting in mind, I returned to the National Butterfly Gardens a week later. During my return visits to the center and nearby locations, I noticed increased activity along the levee that skirts the properties adjacent to the Rio Grande River. I discovered that contractors were busy running surveys along the levee and into the National Butterfly Center property and later found that the proposed border fence was projected to run within feet of where I had photographed *R. secreta* and even closer to the pond where *Libellula gaigei* had been observed. The wall itself would likely not create a physical barrier for Odonata, but widespread habitat destruction on either side of the border wall is likely to have a negative effect on populations that rely on the canals and surrounding forest for ovipositing and feeding, including, potentially, *R. secreta*.

According to Marianna Trevino-Wright, current director of the NABA site, and citing from the NABA website (<https://www.nationalbutterflycenter.org/images/What_the_Border_Wall_will_do_here_.pdf>), the proposed border wall construction will eradicate an enormous amount of native habitat, including butterfly host plants, breeding and feeding areas for wildlife, and lands set aside for conservation of endangered and threatened species, including birds that migrate through this area or overwinter here in the tip of the central U.S. flyway. It will create devastating flooding to all property up to two miles behind the wall, on the banks of the mighty Rio Grande River, and reduce viable range land for wildlife foraging and mating. This will result in greater competition for resources and a smaller gene pool for healthy species reproduction, leading to genetic bottlenecks.

In addition, not all birds can fly over the wall, nor will all butterfly species. For example, the Ferruginous Pygmy Owl, found on the southern border from Texas to Arizona, only flies about 6 ft in the air; it cannot overcome a 30 ft vertical wall of concrete and steel. Nocturnal and crepuscular wildlife, which rely on sunset and sunrise cues to regulate activity, will be negatively affected by

night time flood lighting of the “control zone” the Department of Homeland Security will establish along the wall and new secondary roads. Expanding these areas to vehicular traffic will also increase wildlife roadkill. Animals trapped north of the wall will face similar competition for resources, cut off from native habitat in the conservation corridor and from water in the Rio Grande River and adjacent areas. The humans here will also be cut off from our only source of fresh water in this irrigated desert.

In addition to the NABA lands where numerous U.S. and Hidalgo county records have been accumulated, the lands of Santa Ana National Wildlife Refuge and Bentsen Rio Grande State Park are also in the path of the proposed Border Wall. Protecting these lands from habitat destruction is of utmost importance. The LRGV of Texas offers a corridor for Central American and Caribbean species to become established in the lower portion of the U.S., and range extensions have been well-documented in the past years.

To illustrate the importance of preserving this habitat from destruction, below is a list of rare species with limited ranges that I photographed from 2009–2017 in areas adjacent to or directly in the path of the proposed border wall:

Three-striped Dasher (*Micrathyrus didyma*)
 Spot-tailed Dasher (*M. aequalis*)
 Arch-tipped Glider (*Tauriphila argo*)
 Amazon Darner (*Anax amabilis*)
 Blue-spotted Comet Darner (*A. concolor*)
 Ringed Forceptail (*Phyllocycla breviphylla*)
 Mexican Scarlettail (*Planiplex sanguiniventris*)
 Carmine Skimmer (*Orthemis discolor*)
 Slough Amberwing (*Perithemis domitia*)
 Gray-waisted Skimmer (*Cannaphila insularis*)
 Pin-tailed Pondhawk (*Erythemis plebeja*)
 Claret Pondhawk (*E. mithroides*)
 Black Pondhawk (*E. attala*)
 Turquoise-tipped Darner (*Rhionaeschna psilus*)
 Straw-colored Sylph (*Macrothemis inacuta*)
 Bar-sided Darner (*Gynacantha mexicana*)
 Caribbean Darner (*Triacanthagyna caribbea*)
 Blue-faced Darner (*Coryphaeschna adnexa*)
Remartinia secreta
 Evening Skimmer (*Tholymis citrina*)
 Tamaulipan Clubtail (*Gomphurus gonzalezi*)
 Cream-tipped Swamp Damsel (*Leptobasis melinogaster*)
 Golden-winged Dancer (*Argia rhoadsi*)
 Amelia's Threadtail (*Neoneura amelia*)
 Chalky Spreadwing (*Lestes sigma*)
 Blue-striped Spreadwing (*L. tenuatus*)

Additional species documented by others in the path of the proposed wall are Slender Clubskimmer (*Brechmorhoga praecox*), Red-mantled Skimmer (*Libellula gaigei*), Caribbean



Specialty odonates from the LRGV of Texas, photographed closed to proposed border wall construction site. Upper: Mexican Scarlettail (*Planiplex sanguiniventris*), 18 July 2014, Bentsen Rio Grande State Park. Lower: Claret Pondhawk (*Erythemis mithroides*), 8 June 2014, Santa Ana National Wildlife Refuge. Photos by Tripp Davenport.

Dasher (*Micrathyrus dissocians*), Claw-tipped Blueth (*Enallagma semicirculare*), and Red-mantled Dragonlet (*Erythrodiplax fer-vida*; only U.S. record, Rick Nirschl, 18 December 2012).

Literature Cited

Novelo-Gutiérrez, R. 1998. Description of the larva of *Remartinia secreta* and notes on the larva of *Remartinia luteipennis florida* (Odonata: Aeshnidae). The Canadian Entomologist 139(6): 893–897.



Ohio Odonata Survey Mode 2.0

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It's already a hot, hazy day in Marietta, Ohio on 3 August 2017, and I'm just getting into the swing of our new Ohio Odonata Survey, version 2.0. We did the first survey back in the nineties, a 10-year affair that saw me packing my car much as I'm doing now many, many times. This time, however, it's different.

The times have changed, and so have the tools. I put my new Ohio Gazetteer in the car, but I won't be using it much. I wore the old one out, even with Barb Natterer's great custom cover to protect it in its later years. I transferred some of my favorite collecting sites from the old to the new, but today's drive will be based on the dashboard GPS and a list of roads, turns, and stops scrawled on a piece of paper and based on a GoogleEarth overview of the route made on my computer last night.

I'm wearing convertible nylon pants, a long-sleeved nylon shirt, and a pair of hiking shoes, rounded put by a brimmed hat and a pair of water shoes. No waders today; it's already 75°F on its way to the mid-80s and the streams are warm. I might toss in waders if I expected to get into heavy brush or wade a leech-infested pond, but neither is on today's agenda. My dragonfly vest (a short fly-fishing vest) is in the car; I pull it out to check that the glassine envelopes and a few vials are in the pockets, the loupe lanyard is attached to the D-ring, and the soft forceps are in the upper breast pocket. A scattering of vials and specimen jars (cheap and spill proof!), with and without ethanol, are in a bag in the back.

Now for the nets. I never travel without a small folding net and a few extensions, but I'd be pretty lucky to catch a dragonfly with one of those. The big 21-inch BioQuip net is at school, but the 18-inch Rose Entomology extendable net with dark green netting goes in the back. I might use it, but for the past 10 years or so my go-to net is a folding Fra-bill landing net. Collapsible, with a triangular head and much coarser weave on the bag than an insect net, it can be swung fast and doesn't mind getting wet. Bob Restifo put me on to these and they greatly increased my take of dragons, though it's useless for damselflies.

But the nets will stay in the car on this voyage into a brand new "collecting" world, as the heavy lifting is done by cameras. The little Olympus "Tough" camera that lives in my backpack gets clipped to the shoulder straps of my Kinesis camera rig. I make sure the macro light guide is attached and there is a spare battery in the pack. This little camera isn't much good for dragons or damselflies (although it has excellent macro capabilities); I carry it as a quick wide-angle lens to record habitats. It takes decent pictures and will record in RAW, so if I mess up the exposure I can usually recover in Photoshop. The built-in GPS is a bonus,

as is the fact that it is waterproof and I don't fear carrying it into any situation.

In the side bag of the rig goes my Canon EOS 80D SLR with a 100mm macro attached. The 80D has a decent built-in flash that will allow me to shoot at my normal macro setting (f10, 1/200 sec., ISO 200). I could toss on the macro ring flash, but I probably won't use it. Nestled in with the 80D is my Canon SX-60 with its ridiculous 65x (1365mm equivalent) zoom lens, in case I see any noteworthy birds or a Sasquatch. The front pocket has spare batteries for both, as well as a "CSI-type" photo ruler and MSSH (MaLisa Spring Standard Hand; don't ask).

The back of the rig has an open water bottle carrier with a bottle of water and a lens pouch with my wide-angle 10-22mm lens. I often toss the heavy 17-55mm lens in, but not when I'll be in the water. The SLR holster, front left, has the real workhorses—a Canon EOS 7D MKII with a mounted 100-400mm zoom lens. The 7D has many features that make it ideal for this work, but the biggest one is the built-in GPS which will record the exact location where each shot is taken and upload it to iNaturalist. I don't even carry my handheld GPS anymore. The 100-400 is an amazing close-focus lens; I can focus on my toes and I'm not very tall. It's great for dragonflies and does a respectable job with damselflies. I will take 273 photos today (after editing out bad ones), all but four with the 7D and the 100-400. On a similar trip in, say, 1998, I might collect 20 specimens and take 70 pictures (on slide film). Today I'll photograph 18 species at nine different sites; overall I'll generate about 6x as many records (observations of a single species at a specific site at a particular time).

I head out about 11:30 am. The first stop is close by, over the hill and out of town the back way, driving county roads to a point on Duck Creek where a township road branches off to the east across a concrete ford. The ford is high and dry today



American Rubyspot (*Hetaerina americana*), Duck Creek, Ohio.

and the concrete is hot in the sun. I first spot a Dusky Dancer (*Argia translata*) sunning himself on a Water Willow (*Justicia americana*) leaf hanging out over the brown water of the creek, a tributary of the Ohio with its origins in Noble County. My attention is quickly drawn by something bigger perched on the concrete of the crossing and I'm able to grab a couple of quick shots of my old nemesis the Black-shouldered Spinyleg (*Dromogomphus spinosus*) sunning itself. Every time I see one I get excited, thinking I'm seeing some exotic gomphid, and every time I'm disappointed, though *D. spinosus* is spectacular in its own right. Hereabouts they often are blue-colored, something not really covered in any of the field guides. This one, however, is the more normal yellow and black.

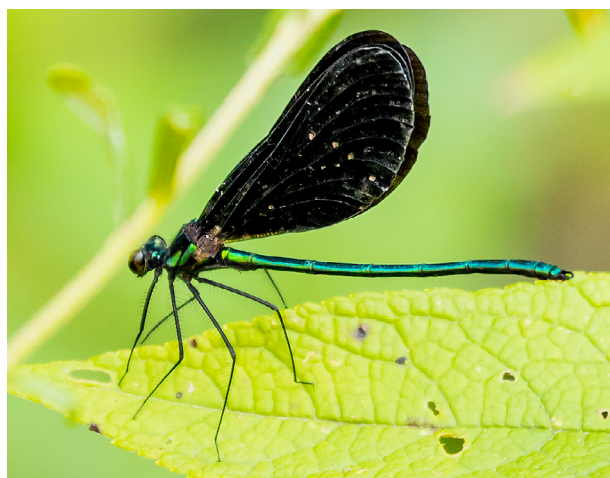
Other odonates soon appear and within six minutes of arriving, I see my 3rd species and get a shot of a male *Argia moesta* (Powdered Dancer). The males' powdery coats are distinctive, but the females can easily be confused with some female Blue-fronted Dancers (*A. apicalis*). Next, I spot one of my favorites, an American Rubyspot (*Hetaerina americana*) perched on its totem plant, Water Willow. The association between the two species is strong; it won't be for another week that I'll discover, for the first time in my experience, an American Rubyspot NOT associated with this plant.

Seconds later record five is in the books as an in-wheel pair of Blue-ringed Dancers (*A. sedula*) light on the same Water Willow. I like to photograph pairs in wheel or tandem as it gives a quick comparison of male and female, identification of the female is easier in association with the male, and it helps document that the species is actually reproducing at the site. That's five species in about eight minutes.

Things slow down a bit after that. I notice a larger species flying, and I'm pretty sure it's another old friend, Swift River Cruiser (*Macromia illinoiensis*). On the nearby Little Muskingum River, or as I like to call it, the Little *Macromia* River, I can "easily" catch this elusive bug as the narrow stream funnels them into a few places that I know very well. This spot is a lot wider and several cruisers are patrolling over deep water above and below the ford. I consider getting out the net, but instead try to get a picture in flight. I back off the 100-400 to about 135mm (which is about 200mm effectively on the APS-C sensor of the EOS 7DII) and take a LOT of pictures. Fortunately, this isn't film so there's no real cost, but I'm taking so many pictures it seems like my camera is getting heavier! After 10 minutes I think I have a few shots in clear focus that show enough of the thorax and abdomen, with its characteristic yellow "tail light" on the 7th segment, to make a solid ID, but I won't know until I'm home looking on a big monitor.

A little after noon I drive up over the divide into a new watershed, Pawpaw Creek. It's been a while since I've worked here, which is a shame as it's a lovely stream that feeds into Duck Creek

upstream of my first stop. I stop at a few promising sites but don't see any odes, which seems odd. Finally, where a township road branches off and crosses over Pawpaw Creek on a small bridge, I see a male Ebony Jewelwing (*Calopteryx maculatum*). It seems late in the year for them, but later when I check I'm surprised to discover that they are on the wing in Ohio through late September. You never know what color they will be, as their iridescent bodies may look green, blue, or black depending on the angle of the sun, but this one gives me a nice pose and is iridescent green, my favorite color for these. Seven species now from two sites. A few miles further, where the stream comes very close to the road, I pull off and patrol the sunny bank for a few minutes. There's something flying but it takes a few minutes to spot it and get close; it's another Dusky Dancer. Seven species, eight records, three sites.



Ebony Jewelwing (*Calopteryx maculata*), Pawpaw Creek, Washington County, Ohio.

I follow Pawpaw Creek on county roads until I'm over the hill at the divide of its watershed. I make a few stops along the way but don't see any odes. Past the divide, I turn northwest on Ohio 565 and head towards Harrietsville. Just shy of town I turn north on Ohio 145, which parallels the east branch of Duck Creek. I'm now in Noble County instead of Washington, and Noble isn't as well-studied. A short way up the road it takes a ford over Duck Creek, and I discover a great little wadeable site.

At this point I've kept my feet dry. There are a number of unwanted hitchhikers that can ride along on one's clothing and boots from stream to stream, one of which is *Didymosphenia geminata*, a diatom also known as didymo or Rock Snot. It's probably native to North America, but it's turning up more and more, and its distribution map suggests it is unusually common in trout streams, which is perhaps a hint that it is being spread on the waders of fly fishermen, if not aquatic scientists. There is also some suspicion that it's always been here, but changes in the environment due to humans is causing it to bloom more frequently. The nearest site with didymo is in the mountains of West Virginia, but you can never be too cautious, as our own

streams are not as well-monitored for it as they should be. To prevent the spread, you need to disinfect your clothes with bleach and/or dry them thoroughly, which really isn't practical when you are in the field working out of the back of a car, and particularly when you aren't wearing waders and thus one of the things to be disinfected with bleach is your already pale, hairy shins. I'm being cautious by not getting in the water too much, and if I do, staying in the same watershed and working downstream so that if didymo is present I won't be taking it anywhere it isn't going to go on its own. I also keep a close eye out for any unusual growth of diatoms, as its thick, mucus-like stalks give rise to the common name. If it ever does show up in Ohio I'll probably take to wearing my waders more; I've never had the felt-bottomed boots that are one of the main avenues of dispersal, but in the future I'll probably get rubber-boot waders that are easier to clean.

My new site is productive immediately; I get a nice picture of the beautiful Violet Dancer (a.k.a. Variable Dancer, *Argia fumipennis violacea*), then spend several minutes trying to get a good flight shot of one of the Swift River Cruisers in the area. It's another spot where I could easily catch one of these fast fliers with a net, but I'm reluctant to get my feet wet shy of my main objective of the day. My net stays in the car and by 1:30 p.m. I'm in my car making few notes about the site, which I'll want to revisit earlier in the flight season next year.

My notes, like my "collecting," have changed a lot since the last survey. I used to record location and time in and out in a Rite in the Rain notebook with waterproof ink. I would also make a few notes, mention what I had caught (I didn't want to do a Darwin and end up with specimens whose location I didn't recall if they got separated from their marked envelope), and record the GPS coordinates. If it was the first time at a site, I'd also make a small map of where I collected. On this trip, all I'm recording is the water body, nearest road(s), and the time in. Everything else is captured by the camera—the exact time I saw the specimen photographed as well as its GPS location. When I drop the image onto iNaturalist the computer will pull out the GPS data and show me a map/satellite image of the exact collecting location. However, since this site looks promising I also note its location on my Gazetteer. Eight species, 10 records, four sites.



Powdered Dancer (*Argia moesta*), Captina Creek, Belmont County, Ohio.



Eastern Amberwing (*Perithemis tenera*), Monroe Lake, Monroe County, Ohio.

I follow Ohio 145 across the high country of Noble and Monroe Counties before turning right at Miltonsburg down a gravel road to a boat launch on Monroe Lake. I've sampled by the dam before, but never at this end, and it's not a disappointment; there is a lot of aquatic vegetation, a small dock (where a young boy catches his first fish while I'm there), and some hiking trails. Many of the usual suspects are there; within two minutes I've photographed males of Common Whitetail (*Platthemis lydia*), Eastern Amberwing (*Perithemis tenera*), and Eastern Pondhawk (*Erythemis simplicicollis*). A short hike around the peninsula left of the docking area yields a male Widow Skimmer (*Libellula luctuosa*), another Violet Dancer, and a male Blue Dasher (*Pachydiplax longipennis*). Lilypads on the far side of the peninsula harbor some Blue-ringed Dancers. The return to the parking lot brings new players to the table including a wheel of Blue-fronted Dancers, a Halloween Pennant (*Celithemis eponina*), and a diminutive female Fragile Forktail (*Ischnura posita*). The tally at 2:30 p.m. now stands at 16 species, 19 records, and five sites.

I head northwest to the main focus of today's trip, Captina Creek. Like the Little Muskingum, Duck Creek, Ohio Brush Creek, and Yellow Creek, Captina Creek is a medium-sized tributary of the Ohio River. Like many of those streams it does not flow through a major city and has a reputation for decent water quality (hellbenders live in it), though the coal, oil, and gas industries have greatly modified its watershed. At this point I've lost track of how many times I crossed the new Rover Pipeline now being built, as well as several other pipelines being laid to take advantage of the Marcellus and Utica shale plays in eastern Ohio. It's heartening to see the "great care" pipeline companies are taking to minimize environmental damage! I haven't been

on Captina Creek in about 25 years, and unfortunately I forgot where some of the nicer sampling points are.

Once near the source of Captina Creek I head downstream on Ohio 148 along the northern branch. I stop at several places noted from an exhaustive GoogleEarth reconnaissance, but none pan out until I hit the spot where Belmont County Rd. 92 (4th county for the trip!) crosses the creek and a small dirt road leads down to the water. Four species are flying: Blue Ringed and Powdered Dancers, Fragile Forktails, and a Common White-tail patrolling a filled 4-wheeler rut on the dirt road. Unsure of the right-of-way (although this is obviously a well-used fishing hole), I don't wade at this lovely site. No new species here, but four new records and a 6th site.

Ohio 148 is a busy road with coal truck, oil rig, and pipeline traffic, and I pass by a few spots that look too dangerous to pull over until I find a sunny stretch about 15 minutes down the road. The bank is steep, so I can't get down to the creek, but it's been recently mowed, which allows some visibility. Here the 100–400mm lens comes into its own; with apparent magnification similar to a 12x pair of binoculars (plus image stabilization), I can scan the snags and rocks with some hope of getting an identifiable image. First up is a Blue Dasher perching on a snag, followed by yet another Blue-ringed Dancer, which is fast becoming the species of the day. A dragon with bright green eyes is flying around, but never perching. It's tough to get a flight shot, but finally I manage it; the green eyes, lack of a yellow tail light, and spots on the wings strongly suggest Prince Baskettail (*Epiptera princeps*). I photograph several individuals which I am pretty certain are Blue-fronted Dancers, but later on the computer screen I realize I can't rule out Powdered Dancer, so I don't submit them to iNaturalist. Likewise, in one of my flight shots of the Prince Baskettail I can "clearly" see what has to be a female American Rubyspot, but it isn't good enough for iNaturalist, and considering some of the craptastic shots I HAVE posted there, that's saying something. Three more records, no new species.

No other sites look good (or safe) on my way down to the Ohio at Powhatan Point, so it's north on Ohio 7 though the industrial Mordor of the Ohio River Valley. Not many chances to get off the road, and the mostly sunny day is now showing a few pop-up thunderstorms. I drive through Steubenville and up to Jefferson Lake State Park in Jefferson County. The lake is a typical lentic habitat, with a mowed shoreline hosting a lot of geese. I wasn't hopeful that I'd find much, but there was some rooted aquatic vegetation and with a little searching a lot of the usual suspects showed up. First was a surprisingly shy Common Whitetail that I had to chase a bit before it would light for me. An Eastern Pondhawk wasn't nearly as shy, nor was a tiny male Eastern Forktail (*Ischnura verticalis*), the first seen today. A number of Eastern Amberwings were about; this species can be very frustrating to photograph when there are a lot in a small area, as they land for a second before darting off to chase or be

chased by another male. That was the case here until I came across a pair in wheel on a patch of floating vegetation. I also started seeing a number of Orange Bluets (*Enallagma signatum*). You'd expect a gaudy orange damselfly to stick out in a world dominated by greens and browns, but these little damsels have an uncanny ability to light on floating vegetation in such a way that their color blends in with wounds, diseased areas, stems, or other irregularities on the plants. I managed a few photos of one pair in wheel on a small patch of unmowed shoreline vegetation. After almost 40 minutes I finally got a shot at a Widow Skimmer; I saw them the moment I drove up, but they had proved remarkably reluctant to perch in range of the telephoto lens. With the Widow Skimmer finally digitized I headed to my next stop, noting that even in late summer the light was starting to fade; sunset today will be about 8:30 p.m. It's almost 6 p.m., I have four more stops, and odes are not known to stay out late. Anyway, I added two more species, six records, and county number five.



Orange Bluets (*Enallagma signatum*), Jefferson Lake, Jefferson County, Ohio.

Back on Ohio 43 I head north to Amsterdam. On the way, I cross yet another new pipeline; as I sit writing this in late December I can see on GoogleEarth the scar it left as it traveled south from a collection facility in Carroll County. Half an hour later I'm in a nice little park in Bergholz, still in Jefferson County. The Upper North Fork of Yellow Creek tucks under Ohio 164 and around the edge of the park, and it's a beautiful little stretch of stream. Five days from now I'll pass through again a little earlier in the day and find a Dragonhunter (*Hagenius brevistylus*) and American Rubyspots, but not today. The shade is thick, and I manage to pick up a Powdered Dancer and a Dusky Dancer. It's getting tough to keep the shutter speed up; even with image stabilization I like to keep it over 1/400 sec, but at this point I'm sometimes hitting ISO 800 to pull that off. ISO 800 is my limit on this camera for noiseless images, so something is going to

have to give. Fortunately, for survey purposes not every picture has to be publication-quality so if I have to I can kick up the ISO a few notches. The new standings: 18 species, 31 records, eight sites, and five counties.

Chasing the fading light, I head up Ohio 524, paralleling the Upper North Fork, hoping to stop at a few sites I used in my Master's thesis research on the chironomids of Carroll County. I can still find my pull-offs after 36 years, but this late in the day nobody's home. At Mechanicstown, I get off the state highway and head "cross country" on county road 14. This is high country, with few habitats other than farm ponds. Eventually I get to the headwaters of Stillfork Creek and the marshy area formed by glacial outwash known as Stillfork Swamp, another site I know well from my MS research. The core of the swamp is owned by The Nature Conservancy; back then I had permission to go in, but not today, so I work from the edge of the road and the railroad right-of-way. It's 7:00 pm, the light is low, and not much is flying. I get pictures of only one species, a male and female Eastern Forktail, mistaking the orange female for an Orange Bluet. I end up submitting both to iNaturalist, though probably this represents only one actual record. This puts the stats at 18 species, 33 records, nine sites (plus a few dry holes), and six counties.

I push on to Malvern, where I grew up, and where there are some great sites. I park downtown and walk to the "town square"—a river terrace over Sandy Creek—but don't see anything (I'll be back in a week when the sun is shining and get seven species). In the gathering dusk I drive past the Dairy Queen and the crowd there attests to the fact that the day is over. I check out the banks of the Sandy through the park and note a few good spots to wade—on another day, with more light. For now, it's back on the road, heading north. I stop at Swenson's in Akron for a late dinner and scroll through images on the camera, then north another hour to Avon and the "northern home". It's late, I'm tired, and the images will wait until tomorrow.

On Friday 4 August I start the other part of the job—processing the images. On Survey 1.0, it would have taken all day to process my specimens. The night before I would have placed the dragonflies in glassine envelopes in a Tupperware container, covered them with acetone, weighted them down with a rock, and left them overnight. The damselflies would have gone into the fridge. In the morning the dragons would be spread out to dry and the damselflies would go into the acetone for a few hours. Each specimen would have been placed in a new, clear acetate or polypropylene 3x5 envelope with an index card listing the collecting information and species ID.

Today it's different. The Canon EOS 7D MkII has two card slots; I keep a 64GB card in the compact flash (CF) slot and a 32GB card in the SD slot. The camera records to both, so if something happens to one I have a backup. I use Adobe Bridge to copy files from the SD card to my computer. I have a DROBO disk array

that holds my images, and a "Photos" directory that holds every digital image I have ever taken, back to 2002. Every month I start a new subdirectory (i.e.,

2017_August). With the survey underway, this directory soon has so many pictures it's unmanageable, so it in turn is divided into subdirectories. Yesterday's shots go into a subdirectory named 8_3_17_eastern Ohio. As Bridge copies the files, it adds metadata information. The camera already added the GPS and my copyright when the original file was recorded; Bridge adds details like my contact information and saves the file to the hard drive. Bridge also saves the new files with a filename that has the date plus a 4-digit index number (i.e., 20170803_2269).

I go through the images in Bridge, sorted by date and time, and delete the bad shots. For the remainder, I highlight all taken at a particular site, occasionally looking at my field notebook to compare the time on the images to the time I was at a given site. Usually a break indicates driving time between sites; later in the season I take a habitat shot at the beginning and end of collecting at each site to make transitions more obvious. With all the images from a site highlighted, I add more metadata, i.e., location, city, state, country, etc.; usually this goes into the keyword field as well, since that is more searchable. If I've already been to a site I can do this with a few clicks by calling up a template for that site and appending that data to the image's metadata. If it's a new site, after I update the metadata on the images I make a new template.

On to the ID, where I start at the beginning and work my way through. I recognize many species easily and slap on the name. My Bridge is linked to an extensive keyword database; in one corner of the screen is a hierarchical listing of all the species I've photographed, and for an image of something I have photographed before I just click on a box to add the scientific and common names, family, order, class, and phylum to the keywords associated with the image. For species I haven't photographed before, I add an entry to the database and click on the new box.

Some IDs are tougher, and I generally have two books open at all times. One is the superb *Dragonflies and Damselflies of Northeastern Ohio* by Larry Rosche, Judy Semroc and Linda Gilbert; it usually has 95% of the species I run into. For the damselflies I turn to Ed Lam's *Damselflies of the Northeast*. Occasionally, I have to dig a bit deeper and pull out Dennis Paulson's *Dragonflies and Damselflies of the East*, or consult *Dragonflies and*



Dusky Dancer (*Argia translata*), Upper North Fork of Yellow Creek, Bergholz, Ohio.

Damselflies of Ohio to get a first read on whether something might be a county record, though of course with 17 years and over 15,000 additional records since our first Survey, a number of new county records have appeared. And, of course, there is always BugGuide.net or even an image search on Google to get a feel for variation within a group.

It takes me a few to go through the images, after which I choose the best of all the images of a species from a given site. All are in RAW format, which records a lot more information than a standard compressed JPEG. In particular, a RAW image has enough information to correct for one to two stops of over or underexposure. I open my best images in Photoshop using the Adobe Camera Raw converter, starting with a saved conversion that is pretty good for daylight images and sets exposure, white balance, noise reduction, clarity, lens correction, highlights, shadows, whites, blacks, and so on. If I'm satisfied with the conversion I proceed to Photoshop, if not, I tweak it a bit first. In Photoshop I crop the image to 1920 x 1280 at 100 ppi, use the shake reduction filter to sharpen it, then save it as a JPG with the species name (i.e., *ischnura_verticilis_2269*). Retaining the index number helps me find the original file if I need to. This process is pretty quick; if I had to tweak the camera RAW settings I can then convert the next image using "previous conversion". I often go from RAW to JPEG in under two minutes and I only convert the best image of each species at each site.

The JPG files are copied to my INAT subdirectory; I open that folder in Bridge and filter out all but the images from the day I'm working on. I log into my iNaturalist account (<www.inaturalist.org>) and select "Add Observations". I drop images 10 at a time on the iNaturalist page and it uploads the files and extracts the metadata. I confirm the ID; iNaturalist, working from my metadata and its own artificial intelligence often makes the right choice, or at least close enough that I can easily choose the right ID. I also check the maps iNaturalist produces to pinpoint the collecting site; inevitably these are also correct since they come from the GPS data. Finally, I tell iNaturalist to add all the records to the Ohio Odonata Project.

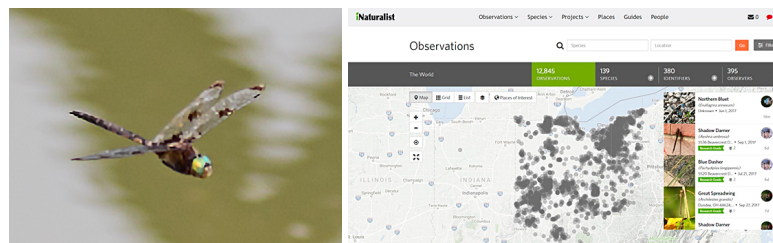
iNaturalist is amazing in several ways, but one of the more remarkable things is how fast IDs are confirmed. If I add 10 files, then go back to add another 10, the first will often have

their ID confirmed by the time the next are up a few minutes later, and this is at 10 p.m. Apparently, a lot of Odonata experts (Greg Lasley!) have a lot of time on their hands! Even the stuff where I pass on a definitive ID, often because of image quality, is confirmed within 24 hours.

Finally, I go back through the JPGs and copy the decent ones to another directory on my DROBO called "Organisms"; this is subdivided taxonomically, with subdirectories for each Kingdom, Phylum, Class, etc. down to species level. The Odonata subdirectory is one of the biggest, naturally. And of course, the Photos and Organisms directories both get backed up. They are copied onto small portable hard drives and synchronized with my office computer (which has its own DROBO) and my Marietta home computer (which just has a single ginormous hard drive, for now). Thus, by 9 August, all the new pictures are on three computers (in two different cities and three different buildings) as well as one portable hard drive, and probably still on the original two camera cards.

I'm sitting in front of my computer in Avon in late December 2017 as I write this, and one thing that strikes me about the brave new survey world is how easy it was to reconstruct a single August day from my relatively skimpy notes. Last summer I made about a half-dozen similar trips, either a drive from Lake Erie to the Ohio or the reverse, or a meandering exploration starting and ending in Marietta or Avon. Each trip involved at least six stops, yet today I can recreate them with ease. The big difference, of course, is the digital photography. Each photo records not only when but where it was taken; dropped into iNaturalist, my trips are like magical footsteps marching across the map. To write this narrative, all I had to do was call up the "INAT" and "8_3_17_eastern Ohio" directories in separate windows on Adobe Bridge, sort them into chronological order, and use the pictures to remind me of exactly what I saw, and when and where I was. Over the course of the writing I also used GoogleEarth and a web browser to confirm geography, research rock snout, and check the title of Dennis Paulson's book. Not much had to come from memory.

I'm also struck by how few specimens I collected last summer. I caught a few of the almost 200 specimens collected by a student I had working on the Odonata of Washington County, but otherwise I collected two specimens all summer, and one was to confirm what might have been a tricky ID from a photo alone. During the first survey, each stop would have taken much longer as I netted specimens and placed them in labelled envelopes. It takes a fraction of the time to take a picture and it's a lot easier to photograph most specimens than it is to catch them. On the old survey I left each site with a list of things I had seen but not caught; given our rules at the time, those lists were essentially worth-



Left: Not all photos have to be great; Prince Baskettail (*Epitheca princeps*) at Captina Creek, bad for publication but good enough for ID. Right: Screenshot of iNaturalist Ohio Odonata Survey Project, 28 Dec. 2017.

less. Of course, some specimens refuse to be photographed, but overall I'm confident that I document a higher percentage of the fauna by photographs than I would by collecting.

Still, there are definite advantages to collecting. For some groups, there are species that just can't be separated by photographs. I have a bunch of *Sympetrum* species on iNaturalist that would be identified if I had collected them (and they are pretty easy to catch; I need to be less lazy next fall). No one will ever be able to do a DNA study of my photographs, but my specimens, preserved in a museum, will be accessible to researchers for a century or more.

What's most amazing is how modern citizen science, digital photography, the internet, and specialized sites like iNaturalist have revolutionized survey work. In 1990–2000, we had over 300 volunteers band together to collect over 25,000 specimens (as well as to document specimens preserved in museums since the 1800s), enabling us to document about 164 species. As I sit here on 28 December 2017, the current total on iNaturalist is 12,845 records and 139 species compiled by 395 people. I was able to add 577 records (some from previous years) and 55 species; the champ, Jim Lemon, had 89 species from 1,775 records. I'm looking forward to seeing what the next two years will bring!



Dragonfly Society of the Americas Odonate Research Grant Program

Nancy McIntyre <Nancy.Mcintyre@ttu.edu>

In 2017, the DSA Executive Committee formed an Odonate Research Grant Program to award small grants (\$500–1000) to help pay expenses for odonate research in the DSA focal region of the New World. The funds will be from surplus in the DSA accounts after operating expenses as approved by the Executive Committee and any donations designated for that purpose. Donations should be coordinated with DSA Treasurer Cindy McKee <treasurer@dragonflysocietyamericas.org>. For more information, see “Minutes of the DSA Annual Business Meeting, 10 June 2017, New Business,” ARGIA, Vol 29, No. 3, pp. 8.

A committee was developed (Nancy McIntyre [chair], Chris Hill, Bryan Pfeiffer) to develop a set of submission guidelines and to evaluate grant proposals.

Frequently Asked Questions

Who is eligible to apply for a grant? Currently, we are only able to make awards to members of DSA from the U.S. We cannot make awards to members of DSA from outside the U.S. Non-members are not eligible.

If I am a U.S. member of DSA but my proposed research is not in the DSA focal region (the Americas/New World), am I eligible to apply? No.

Can a person who has received a DSA grant in the past be eligible in the future? Yes, recipients can receive multiple grants as long as the obligations outlined below are met for each grant.

How frequently will requests for grant proposals occur? We anticipate this occurring on an annual basis, with a set deadline of 1 February. Awardees will be notified by 15 March. For 2018 only (inaugural year), applications will be reviewed as received, with a deadline of 1 May for funding in 2018.

How many grants will be awarded each year? It depends on the number of meritorious proposals received, amounts requested by those proposals, and funds available in the DSA Odonate Research Grant Program account. For 2018, we anticipate 1–5 awards of \$500–1000 each.

What criteria will be used to evaluate grant proposals? The committee will evaluate proposals based on scientific merit/importance, feasibility, and clarity.

How will the funds be awarded, and are there any restrictions on what can be covered? Awards will be made by a check mailed to the awardee; wire transfers are currently not an option. Awards cannot be used for salary, only for travel, services, supplies, or equipment. Awards will be mailed within three weeks of final approval.

What obligations are associated with receiving a grant? Awardees must submit a progress report to the DSA Executive Committee within one year of the grant award; failure to do so will render the recipient ineligible for any future DSA grants. Awardees are strongly encouraged to give a presentation at a DSA meeting or submit a paper to ARGIA or Bulletin of Odonatology within one year of project completion.

How can I donate to the DSA Odonate Research Grant Program? Please contact the DSA Treasurer, Cindy McKee, at <treasurer@dragonflysocietyamericas.org>. Thank you for your support of this program, which is made possible by donations from our members. And special thanks to Steve Berliner for his generous donation in March 2018!

How can I apply? Fill out the Grant Application Form (see below), save it as a PDF, and e-mail to Nancy McIntyre at <nancy.mcintyre@ttu.edu> before the 1 May 2018 deadline.

DSA Odonate Research Grant Proposal Instructions

Only proposals using this format will be considered.

E-mail a PDF of the form to Nancy McIntyre at <nancy.mcintyre@ttu.edu>.

Proposal must be received by 1 May 2018. You will receive an e-mail acknowledgment that your proposal was received.

Please do NOT:

- Submit your proposal by mail.
- Submit your proposal in a form other than PDF.
- Reformat the Proposal Form (e.g., alter font size) or exceed the allotted three pages.
- Include supplemental attachments.
- Contact DSA to check on the status of your proposal. All participants will be notified by 1 June 2018 whether or not they will be awarded funding.

DSA Odonate Research Grant Proposal Form

I. Applicant Information

Name(s) of Applicant(s) and Affiliation(s) (if applicable):

(For projects with more than one researcher, please indicate the primary applicant to whom the award check would be mailed.)

Contact Information (including U.S. mailing address, phone, e-mail):

Researcher Qualifications (briefly describe your qualifications for this project, including relevant current and past activities):

II. Project Information

Project Title:

Amount Requested (not to exceed \$1,000):

Start Date (month, year):

Completion Date (month, year):

Project Summary (100 words maximum):

III. Project Description (2 single-spaced pages, including Literature Cited)

Include objectives, an explanation of the scientific importance of the study and its importance to DSA, methods, and location.

IV. Budget and Justification (1 single-spaced page)

Provide a project budget and indicate how DSA grant funds will be used. DSA cannot pay for salaries, overhead, grant administration, or similar costs (can only be used for travel, services, supplies, or equipment).



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

It's not too late! Annual dues are only \$15, and include: electronic subscriptions to ARGIA and Bulletin of American Odonatology; full access to OdonataCentral; fee discounts at annual DSA meetings; and eligibility to vote in DSA elections and serve on the DSA Executive Committee. A sustaining membership of \$20 (or more!) provides even more support for our organization. You can pay dues for multiple years or take advantage of our new Life (single payment of \$300 US) and Sustaining Life memberships (single payment of \$400 US or more).

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

Spring Book Sale

Bill Mauffray, Managing Director, International Odonata Research Institute; Curator of Odonata, Florida State Collection of Arthropods <iodonata@gmail.com>

Extension of special pricing on *Dragonflies of North America*, 3rd Edition!

Dragonflies of North America, by James G. Needham, Minter J. Westfall, Jr., and Michael L. May. 2014. xvi +680 pp, text figures, (7 x 10 in.), cloth binding. Scientific Publishers, Gainesville, Florida. Act now, because only about 20 copies remain, and a 4th edition of this book is not planned! This most monographic revision of the classic *Manual of the Dragonflies of North America* (Needham and Westfall, 1955) includes additions and corrections for all the currently known species of North American dragonflies (Anisoptera), including all (over 355 species) from Alaska to northern Mexico and the Greater Antilles. Keys to adults and known larvae allow identification of these important aquatic insects. The text is completely revised by Westfall and May, with over 200 added figures for all newly discovered species, an updated checklist to all species, bibliography, glossary, distribution table, and index. Pricing is shown below. The book weighs over 4 lb, so foreign rates are higher due to shipping costs: United States \$180; Canada \$225; Mexico \$230; other countries \$250.

Damselflies of North America, 2nd edition

By Minter J. Westfall, Jr. and Michael L. May, (revised by Mike May). 550pp. Scientific Publishers. 2006. Color supplement, 2007.

The second edition is an enhancement of the first edition published in 1996 which treated the smaller Odonata, the damselflies of North America. It includes northern Mexico and the West Indies and covers 168 species—seven of them new since the first edition. Keys to species and precise descriptions allow identification of all adults and larvae of these important aquatic insects. Written by two well-known experts, this work is the companion volume to *Dragonflies of North America*. Numer-

ous illustrations are included, plus a checklist to species, updated distribution data, and an extensive bibliography, glossary, and index. The page format is altered to conserve space, saving over 100 pages of text and keeping the cost down, but the page size remains the same at 7 x 10 in. Pricing for hard cover version: United States \$90; Canada \$115; Mexico \$125; elsewhere \$125. A few soft cover copies are still available, at prices \$5 less than the hard cover costs above.

Supplementary companion to *Damselflies of North America*, with color plates

Supplemental volume of color plates illustrating all 163 damselfly species with photos taken in nature. This second part to the new edition contains 156 pages and 104 color plates. Sold separately for those wanting to add it to their copy of the first text edition: United States \$60; Canada \$95; Mexico \$100; elsewhere \$100.

Combination package of *Damselflies of North America* plus color plate Supplement:

United States \$140; Canada \$180; Mexico \$195; elsewhere \$205

All prices are in U.S. dollars (USD) and payable in advance by check or money order to International Odonata Research Institute (IORI). Prices for U.S., Canada, and Mexico orders are flat rate and include shipping and handling; for all other locations, pricing should be verified first by e-mail. In the U.S., Florida residents must add 6.25% sales tax. To pay by credit card send an e-mail to <iodonata@gmail.com> for instructions; a 3% surcharge will apply.

Orders should be sent to Bill Mauffray, 4525 NW 53 Lane, Gainesville, Florida, USA, 32653. Shipments will be made within a week of receiving the order. All profits go to IORI.



Dragonflies of Sri Lanka Nature Tour, 24 November–4 December, 2018

Dennis Paulson is leading an odonate-oriented nature tour in Sri Lanka from 24 Nov.–4 Dec. 2018. There have been 124 dragonfly species identified on the lush island of Sri Lanka, almost half of which are endemic. Odonates are the focus of the tour, but of course we will also look for many of the special endemic bird species as well as butterflies, mammals, and reptiles found here. Find all the details for logistics and registration on the Sunrise Birding website at <<http://www.sunrisebirding.com/18SriLankaDragons/index.html>>.

Annual Treasurer's Report

Cynthia McKee, DSA Treasurer <treasurer@dragonflysocietymerica.org>

The following information is furnished as an annual report.

11:14 AM

01/05/18

Accrual Basis

Dragonfly Society of the Americas, Inc.

Balance Sheet

As of December 31, 2017

	Dec 31, 17
ASSETS	
Current Assets	
Checking/Savings	
10000 · Cash In Bank - Checking	
10100 · Cash in Bank - Bank of America	32,325.08
Total 10000 · Cash In Bank - Checking	32,325.08
Total Checking/Savings	32,325.08
Other Current Assets	
11500 · Due from PayPal	90.74
13000 · Prepaid Expenses & Deferred Chg	
13100 · Prepaid Website Hosting Costs	500.00
Total 13000 · Prepaid Expenses & Deferred Chg	500.00
Total Other Current Assets	590.74
Total Current Assets	32,915.82
TOTAL ASSETS	32,915.82
LIABILITIES & EQUITY	
Liabilities	
Current Liabilities	
Other Current Liabilities	
23000 · Deferred Membership Dues	
23018 · Deferred Membership Dues 2018	885.00
23019 · Deferred Membership Dues 2019	330.00
23020 · Deferred Membership Dues 2020	90.00
23021 · Deferred Membership Dues 2021	75.00
23022 · Deferred Membership Dues 2022	30.00
23026 · Deferred Membership Dues 2026	15.00
23027 · Deferred Membership Dues 2027	15.00
23028 · Deferred Membership Dues 2028	15.00
Total 23000 · Deferred Membership Dues	1,455.00
Total Other Current Liabilities	1,455.00
Total Current Liabilities	1,455.00
Total Liabilities	1,455.00
Equity	
30000 · Opening Balance Equity	26,862.68
32000 · Unrestricted Net Assets	1,992.55
Net Income	2,605.59
Total Equity	31,460.82
TOTAL LIABILITIES & EQUITY	32,915.82

11:19 AM

01/05/18

Accrual Basis

Dragonfly Society of the Americas, Inc.
Statement of Financial Income and Expense
 January through December 2017

	Jan - Dec 17
Ordinary Income/Expense	
Income	
43100 · Membership Dues	
43110 · DSA Membership Dues Regular	2,450.00
43120 · DSA Membership Dues Sustaining	2,780.00
Total 43100 · Membership Dues	5,230.00
43200 · Annual Meeting Income	
43210 · Meeting Registration Fee	2,225.00
43220 · Annual Meeting T-Shirt Receipts	672.00
43230 · Annual Meeting Dinner Receipts	1,192.00
43250 · Annual Meeting Dorm Receipts	200.00
Total 43200 · Annual Meeting Income	4,289.00
43400 · Contributions	
43410 · Individual Contributions	30.00
43450 · Other Contributions	100.00
43460 · Memorial Contributions	
43461 · Memorial - Clark Nelson Shiffer	100.00
Total 43460 · Memorial Contributions	100.00
Total 43400 · Contributions	230.00
Total Income	9,749.00
Gross Profit	9,749.00
Expense	
60900 · Business Expenses	
60920 · Corporation Registration Fees	61.25
Total 60900 · Business Expenses	61.25
62100 · Contract Services	
62160 · TACC Computer Expense	1,000.00
Total 62100 · Contract Services	1,000.00
63000 · Annual Meeting Expenses	
63100 · Meeting Facility Expense	315.00
63200 · Annual Meeting Dinner Expenses	1,383.23
63250 · Annual Meeting Breakfast Exp	389.50
63300 · Annual Meeting T-shirt Expenses	575.60
63400 · Annual Meeting Buttons Expense	118.66
63500 · Annual Meeting Supplies	180.19
63700 · Annual Meeting Dorm Payments	200.00
Total 63000 · Annual Meeting Expenses	3,162.18
63900 · Grants Awarded	
63910 · Nick & Ailsa Donnelly Grant	1,500.00
Total 63900 · Grants Awarded	1,500.00
63950 · Sponsorships	
63960 · Entomological Collections NW	500.00
63970 · SOL Latin America Odon Society	458.04
Total 63950 · Sponsorships	958.04

11:19 AM

01/05/18

Accrual Basis

Dragonfly Society of the Americas, Inc.
Statement of Financial Income and Expense
 January through December 2017

	Jan - Dec 17
65000 - Operations	
65020 - Postage, Mailing Service	9.80
65060 - Software Expense	239.88
65070 - Bank Fees	35.00
65080 - PayPal Fees	177.28
Total 65000 - Operations	461.94
Total Expense	7,143.41
Net Ordinary Income	2,605.59
Net Income	2,605.59

Treasurer's Letter

I am pleased to present the Dragonfly Society of the Americas, Inc. (DSA) Financial Report for the year ending 31 December 2017. These year-end reports include the Statement of Financial Position and Statement of Financial Income and Expense.

The DSA's 2017 total revenue was \$9,749.00 and total operating expenses were \$7,143.41 and a net income for 2017 of \$2,605.59.

Of the total revenue, membership dues were \$5,230.00. Paid membership for 2017 was 370 members.

During 2017 the Society awarded two Nick & Alisa Donnelly Grants and sponsored two organizations, the Entomological Collections Network and the SOL Latin America Odonata group.

Submitted by Cynthia McKee, DSA Treasurer



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, videos, and scientific publications to me at <editor@dragonflysocietyamericas.org>. A sampling of recent newsworthy Odonata includes:

Amundrud, S.L., M. Videla, and D.S. Srivastava. 2018. Dispersal barriers and climate determine the geographic distribution of the helicopter damselfly *Mecistogaster modesta*. *Freshwater Biology* 63(2): 214–223. Species' ranges are typically constrained by the interplay of physical barriers to dispersal, environmental requirements such as suitable climatic conditions and biotic constraints such as from predation or competition. However, teasing apart the relative importance of these constraints in determining species distributions still represents a major challenge for ecologists. The Neotropical damselfly *Mecistogaster modesta* (Coenagrionidae: Odonata) inhabits wet and moist forests in mainland Central America and north-western South America. This habitat specialist spends its larval development exclusively in tank bromeliads, where it acts as a keystone predator within the aquatic food web. Although tank-forming brome-

liads occur from the southern United States throughout most of South America, *M. modesta* is absent from the Caribbean islands and South America south-east of the Andes mountain chain. We employed species distribution models to explore the relative importance of physical barriers (Andes mountain range and oceanic barriers), climate (mean annual temperature and annual precipitation) and biotic interactions (competition from other bromeliad-dwelling odonates) in limiting the geographic distribution of *M. modesta*. We found that dispersal barriers strongly limit the geographic distribution of *M. modesta*. In addition, its range is restricted by low temperatures and low precipitation. Competition from other bromeliad-dwelling odonates was not important in limiting the damselfly's range. Because of the physical barriers to dispersal, *M. modesta* does not occupy its full potential geographic range. Specifically, our model predicted suitable habitat on the Caribbean islands and throughout most of South America, where the species is currently absent. These findings have important conservation implications, particularly as the aridification of rainforests and subsequent localised extinctions due to climate change continue. On the other hand, the species may respond to warming temperatures by tracking

climate to higher elevations, with subsequent effects on naïve high-elevation bromeliad food webs. An upwards migration could also increase the probability of *M. modesta* overcoming the dispersal barrier presented by the Andes, enabling the damselfly to invade large areas of suitable habitat in South America.

Chari L.D., S. Moyo, and N.B. Richoux. 2018. Trophic ecology of adult male Odonata. I. Dietary niche metrics by foraging guild, species, body size, and location. *Ecological Entomology* 43(1): 1–14. Information on the dietary niches of adult odonates is sparse, as they are highly mobile and evasive animals, which makes them difficult to observe in their natural habitat. Moreover, there is a lack of knowledge on how varying behavioural traits of odonates relate to phenomena like niche partitioning. This study investigated niche partitioning amongst odonate species, foraging guilds and size classes in a riverine system in the Eastern Cape province of South Africa. A combination of stable isotope and fatty acid-based niches was used to infer odonate feeding. Both fatty acid and stable isotope-based niches showed that there was niche separation amongst odonates that forage in flight (fliers) and those that forage from a perch (perchers), amongst odonates of different size classes (damselflies, medium- and large-sized dragonflies) and amongst species, although varying levels of niche overlap were observed in each case. Niche sizes of odonates varied between an upstream and a downstream site. Generally greater niche overlap was recorded at the narrow upstream site (associated with low insect emergence rates) than the wider downstream site (associated with high insect emergence rates), indicating that a greater degree of resource sharing occurred at the upstream site where aquatic food was less abundant. The findings of this study suggest that dietary niches of odonates can be influenced by foraging guild, body size, and/or environmental conditions, and additional study in a variety of regions is recommended to determine the greater applicability of these findings.

Cuevas-Yañez K., J.C. Espinosa-Rivera, A.P. Martínez-Falcón, and A. Córdoba-Aguilar. 2017. Are all Mexican odonate species documented? An assessment of species richness. *Systematics and Biodiversity* 15(3): 253–258. With the aim of protecting Mexican diversity, one current governmental task is to complete national biological inventories. In the case of odonate insects, several researchers have hypothesized that species richness is complete (205 dragonflies and 151 damselflies), but there has not been any formal exercise to test this. Thus, we have investigated whether odonate species richness (for Mexican endemics, dragonflies [suborder Anisoptera], damselflies [suborder Zygoptera] and total species) is complete using sample-based and coverage-based rarefaction curves. Along with

this, we also showed how good distribution data are in the country. The rarefaction curves indicated 100% completeness for all groups suggesting that the inventory is complete. However, species' distribution data is highly patchy regarding areas either well (e.g. central Mexico) or badly (e.g. coast of Guerrero and Oaxaca) collected. We encourage researchers to continue odonate sampling in order to support at least three conservation actions: (i) conservation assessment of endangered species; (ii) knowledge of range shifts given rising global temperatures; and (iii) increase public interest and awareness in protected, touristic areas.

Dolný A., H. Sigutová, S. Ozana, and L. Choleva. 2018. How difficult is it to reintroduce a dragonfly? Fifteen years monitoring *Leucorrhinia dubia* at the receiving site. *Biological Conservation* 218: 110–117. Conservation translocations (including reintroductions) are potentially powerful tools for wildlife conservation, and their use has increased worldwide. However, most studies have focused on vertebrates, with the long-term impact and ecological progress of translocations being neglected. Moreover, such projects rarely target insects. The present study reports the long-term persistence of a population of *Leucorrhinia dubia* (Odonata: Libellulidae) reintroduced to artificially created bog pools in the Czech Republic. Eighty penultimate instar *L. dubia* larvae were translocated in 2001, and the dragonfly assemblage at the reintroduction site was monitored for 15 years following larvae release. In 2015–2017, the capture-mark-recapture method, the Jolly-Seber model, and exuviae collection were used to evaluate the demography of the translocated population. Microsatellite analysis was performed to assess the genetic variability of source and reintroduced populations. Over the monitored period, population size increased (80 larvae released vs. 108–115 exuviae and 75 adults at the end of the study) and *L. dubia* became a dominant species, whereas the composition and abundance of the local dragonfly assemblage were not substantially changed. These results indicate that reintroductions are effective measures for dragonfly conservation, as translocating a relatively small number of individuals led to the establishment of a self-sustaining population. Using penultimate instar larvae was optimal for dragonfly translocation, but the availability of a high-quality habitat and the active collaboration with nature conservation authorities were vital for the successful outcome. Genetic analysis suggested that the translocated population might serve as a source of genetic variation for the original population, if depleted.

Gomez-Llano M.A., H. M. Bensch, and E. I. Svensson. 2017. Sexual conflict and ecology: species composition and male density interact to reduce male mating harassment and increase female survival. *Evolution* <<https://doi.org/10.1111/evo.13457>>. Sexual conflict is a pervasive

evolutionary force that can reduce female fitness. Experimental evolution studies in the laboratory might overestimate the importance of sexual conflict since the ecological conditions in such settings typically include only a single species. Here, we experimentally manipulated conspecific male density (high or low) and species composition (sympatric or allopatric) to investigate how ecological conditions affect female survival in a sexually dimorphic insect, the banded demoiselle (*Calopteryx splendens*). Female survival was strongly influenced by an interaction between male density and species composition. Specifically, at low conspecific male density, female survival increased in the presence of heterospecific males (*C. virgo*). Behavioural mating experiments showed that interspecific interference competition reduced conspecific male mating success with large females. These findings suggest that reproductive interference competition between con- and heterospecific males might indirectly facilitate female survival by reducing mating harassment from conspecific males. Hence, interspecific competitors can show contrasting effects on the two sexes thereby influencing sexual conflict dynamics. Our results call for incorporation of more ecological realism in sexual conflict research, particularly how local community context and reproductive interference competition between heterospecific males can affect female fitness.

Harabis F. and A. Dolny. 2018. Military training areas as refuges for threatened dragonfly species: Effect of spatial isolation and military activity. *Biological Conservation* 217: 28–35. A long-term decline in habitat quality and freshwater species diversity has forced conservation managers to consider secondary habitats, such as military training areas (MTAs), that were previously overlooked but have conservation potential. Isolation from many negative anthropogenic influences combined with disturbances associated with military activities can benefit the diversity of terrestrial species. However, little is known about the conservation potential of freshwater habitats that are an integral part of MTAs. In this study, we used dragonflies and damselflies as valuable indicators of habitat quality to compare the diversity of freshwater sites inside and outside MTAs. We randomly selected 16 sites inside four extensive MTAs and 16 reference sites outside MTAs and examined the differences in traits of species occurring inside and outside the MTAs. We found that the diversity and conservation value of dragonfly communities inside MTAs was comparable to that in the most valuable freshwater habitats outside MTAs. Inside MTAs, species were primarily those associated with habitats in the late successional stages, while species associated with early successional stages were absent. Undoubtedly, the conservation potential of MTAs for freshwater invertebrates is in the long-term isolation from negative anthropogenic

influences. Paradoxically, the main potential problem in protecting freshwater habitats inside MTAs is the cessation of military activity.

LeGall M., M. Fournier, A. Chaput-Bardy, and A. Husté. 2018. Determinant landscape-scale factors on pond odonate assemblages. *Freshwater Biology* 10.1111/fwb.13065. Species assemblages are related to environmental factors acting at different landscape scales. Local habitat heterogeneity also contributes to maintain the regional species pool. Understanding factors determining species presence is therefore crucial for formulation of successful conservation and management strategies. Odonates can reveal much about patterns of species assemblages since their presence at a site reflects both their dispersal ability and life cycle constraints. Odonate assemblages were studied at 31 ponds located in three different landscapes: forest, urban and field. The impact of pond geographical distribution and their local characteristics (i.e., vegetation, suspended matter, freshwater macroinvertebrates, pond area and temporariness) on odonate composition, species richness and larval presence were studied. According to their intrinsic requirements, damselfly and dragonfly presence on ponds depended on local characteristics. Some species of the two orders were only detected in field or forest ponds. Moreover, some species were never detected in urban ponds. Differences in odonate assemblages were mainly related to vegetation, freshwater macroinvertebrates and pond area. Species richness was related to predator abundance and pond area, especially for dragonflies. The presence and abundance of odonate larvae were both related to aquatic vegetation, and to contrasted aquatic variables of ponds. Therefore, this study confirms that vegetation within and around ponds determines odonate presence. Interestingly, in a pond, species detected at the adult stage were not always detected at the larval stage, highlighting the need to really consider both parts of the lifecycle when studying odonate assemblages. Diversity of local habitats within and around ponds depends strongly on the surrounding landscape and influences the assembly of odonates. Forest and field ponds presented particularly dissimilar species assemblages. Urban ponds had no specific environmental habitats compared to the other contexts. Species present on these ponds are rather generalist and able to support human disturbances. Overall, this study confirms that pond heterogeneity may be a key factor in maintaining the regional pool of odonate species.

Moskowitz, D. and M. May. 2017. Adult tiger spiketail (*Cordulegaster erronea* Hagen) habitat use and home range observed via radio-telemetry with conservation recommendations. *Journal of Insect Conservation* 21(5–6): 885–895. The Tiger Spiketail dragonfly (*Cordulegaster erronea* Hagen) is geographically restricted to the eastern

half of North America, patchily distributed within the range and a habitat specialist of small spring and seepage fed headwater streams running through mature forest. These habitats are highly sensitive to disturbance and the Tiger Spiketail is of conservation concern throughout most of its range. Yet little is known about the habitat use of either sex away from the breeding stream hampering conservation strategies. In this study we use miniaturized radio transmitters to investigate the habitat use and home range of individual males and a female Tiger Spiketail in New Jersey. This is the first and only radio-telemetry for this species. We also provide recommendations for habitat protection and conservation. Our studies demonstrate that this species is critically dependent upon mature forest and the high quality, perennial headwater streams that run through them. These habitats are particularly sensitive to disturbance. Except when patrolling and ovipositing, both sexes are in the canopy above the breeding stream and in the adjacent mature forest, indicating the inseparable linkage between the aquatic and forested terrestrial habitat for this species. Our observations also suggest that *C. erronea* occurs in a metapopulation of nearby streams in our study area. Conservation of this species may therefore require forest protection far beyond the breeding stream. In New Jersey, and in other places throughout the range, there are many potential pressures on these habitats and current regulatory protections are not likely suitable. These same habitats may also be important for other Odonate species of conservation concern suggesting that protection of *C. erronea* may benefit a suite of species. We hope the information obtained from this study can assist resource managers in developing conservation and habitat protection measures.

Rebora M., F. Frati, S. Piersanti, G. Salerno, R. Selvaggi, and O.M. Fincke. 2018. Field tests of multiple sensory cues in sex recognition and harassment of a colour polymorphic damselfly. *Animal Behaviour* 136: 127–136. The use of multiple sensory modalities in mating decisions has prompted a reassessment of sexual selection in many species. Odonate males have long been assumed to use only visual cues in mate recognition. Using only airborne cues in the laboratory, a previous study of *Ischnura elegans* found that males discriminate between the sexes and exhibit an odour preference for male-like female colour morphs. In a field experiment that required free-flying males to detect and recognize potential mates, we scored nonsexual and sexual reactions of free-flying males to live conspecifics (andromorphic females, which mimic male body colour and pattern; heteromorphic females, which differ from males in body colour and pattern; and males) and empty control dowels positioned at ponds. ‘Nonvisual’ treatments concealed under a muslin bag offered only olfactory cues, whereas the unbagged ‘visual’ treatments offered visual plus odour cues. Live conspecifics in the

nonvisual treatments did not elicit more sexual reactions than control dowels. In contrast, live individuals in the visual treatment elicited more sexual responses than did controls, suggesting that odour alone was insufficient for detection of conspecifics. However, even with visual cues, males reacted sexually towards other males as often as they did towards either female morph, indicating a failure to discriminate between sex or morph. A second, more realistic visual treatment away from water, where 77% of the solitary mature individuals were males, produced similar results. Thus, we measured natural harassment rates of marked, free-flying females. Both female colour types used similar behaviours to evade males. We found no difference in harassment or mating rates between colour morphs. Our results suggest that visual cues of female *I. elegans* act similarly to the context-dependent signal apparency of *Enallagma* colour morphs, and emphasize the need for laboratory results to be validated by comparison of sensory abilities under natural conditions.

Kalkman, V.J., J.-P. Boudot, R. Bernard, G. De Knijf, F. Suhling, and T. Termaat. 2018. Diversity and conservation of European dragonflies and damselflies (Odonata). *Hydrobiologia* 811 (1): 269–282. Based on a distribution database brought together for the recently published Atlas of the European dragonflies and damselflies, we describe the patterns of diversity and endemism of these insect groups. Highest species richness, as well as richness of predominantly lentic species, occurs in central and western-central Europe. Strictly lotic species have their centre of diversity in southwest France and parts of the Iberian Peninsula. The highest number of endemic species is found in southwest France, the Iberian Peninsula and the Balkan Peninsula. A comparison of the diversity patterns of Odonata species listed in the EU Habitats Directive with those listed in the European Red List highlights a strong mismatch between species threatened in Europe, which are mainly found in the Mediterranean, and species legally protected by the European Union, which are concentrated in central and western Europe. This mismatch has a historical origin, as the species listed in the Habitats Directive were mostly selected in the 1970s and 1980s when water quality in western and central Europe was poor. Since the 1990s, water and habitat quality has improved in these parts of Europe while in the same period the pressure on aquatic habitats in the Mediterranean has increased greatly. 

Book Review: Dragonflies of Japan—Nihon no Tonbo by Akira Ozono, Itsuro Kawashima, and Ryo Futahashi

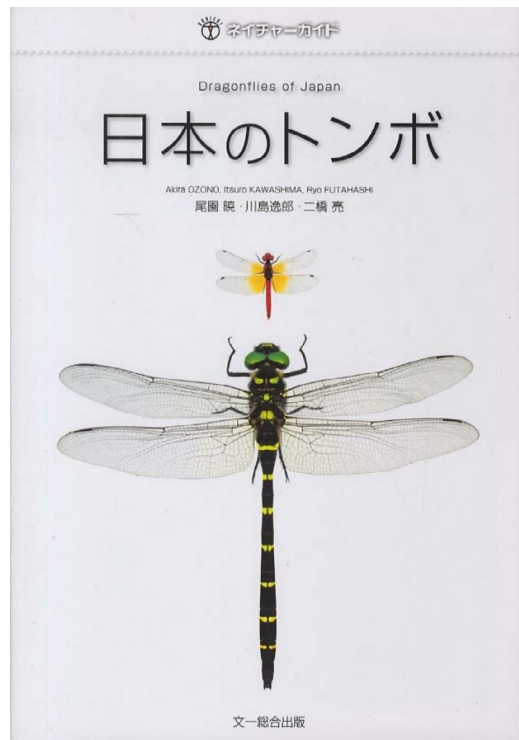
Jake H. Lewis, Saint John, New Brunswick <warblerlife@gmail.com>

Dragonflies of Japan—Nihon no Tonbo by Akira Ozono, Itsuro Kawashima, and Ryo Futahashi. 2012. Bun Ichi Sou Gou Shu Pan (Nishigokenchou, Shinjuku, Tokyo). ISBN 978-4-8299-0119-9. Paperback, 532 pp. £84.99/ \$118/€96 approx.

Nihon no Tonbo is a comprehensive guide to all 203 dragonfly and damselfly species of Japan, from the northernmost tip of Hokkaido to the Nansei Islands in the south. Before delving into species accounts, the authors provide several diagrams illustrating odonate morphology, a “quick-find” family identification table, a map of Japan, and a chart with total body length, hindwing length, and final instar larva length ranges for all species in the guide.

Species accounts are remarkably well-organized. Crisp, high-quality lateral scans of adults (both sexes) and dorsal scans of larvae are provided, in addition to gorgeous “in the field” photographs. All scans indicate where the specimen was collected, and the authors include multiple scans of species that vary geographically in size and/or coloration. A brief description (in Japanese) of distinguishing features is written alongside scans, with arrows highlighting these areas. The distribution map is colored differently for known breeding range, past records (i.e., current status uncertain), migration records, and for different populations. For each species, a brief description (in Japanese) of habitat preferences, morphology, seasonality, and classification is presented along with a short remarks section (primarily on distributional trends). Following the species accounts, side-by-side diagrams of genitalia and other key ID features (e.g. thoracic pattern) are provided.

I was thoroughly impressed by the scan/photo quality, comprehensiveness, and usability of this guide. In my



opinion, this gem surpasses North American guides to the Odonata, and will serve as a “go-to” field guide to Japanese Odonata well into the future. Although largely written in Japanese, even those with no knowledge of the language could easily use this guide to identify the vast majority of adult Japanese Odonata by comparing the lateral scans and diagrams. I highly recommend this book to those interested in identifying Japanese species of Odonata, or even to those looking to add a high-quality natural history reference to their collection. 

ID Corner

ID Corner addresses the challenges we face as print and electronic 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 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@dragonflysocietymamericas.org>. 

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 origi-

nal 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, Dennis Paulson waxes lyrical about a relatively unsung portion of odonate anatomy.

The Miraculous Rectum, by Dennis Paulson
<dennispaulson@comcast.net>

Where digested remains have just gone their way,
fresh water comes into it, saving the day.

Nobody loves the rectum; at best they say ‘ew.’
If you try to correct ‘em, you convince very few.

Oxygen’s taken up by tracheae tiny,
and CO₂ purged through the opening spiny.

But this part of the body, so important to the nymph,
is something to admire, so don’t just say “hmp.”

So respiration’s served, but “What else?,” you ask.
there’s also locomotion for still another task.

The rectum in a nymph, surprising as it seems,
does more than just digestion; it has other schemes.

The abdomen’s compressed, the water goes south,
and the larva shoots out from the predator’s mouth.

This miraculous organ has three different uses,
and they function alike in all ode cabooses.

So if anyone asks you where to direct ‘em
for dragonfly miracles—point to the rectum.



Call for Papers for the Bulletin of American Odonatology (BAO)

The Bulletin of American Odonatology is DSA’s peer-reviewed journal for reporting research on Odonata of the New World. Submitted articles may include faunal synopses, behavioral analyses, and ecological studies. BAO also publishes taxonomic studies, but will not consider the publication of new names at any taxonomic level.

See the last page of this issue of ARGIA for the BAO publishing guidelines. Article submissions or questions should be directed to Steve Hummel, BAO Editor, at <editor@dragonflysocietyamericas.org>.

Last Copies of The Dragonflies and Damselflies of New Guinea, Maluku, and the Solomon Islands

John Michaelski, author of “The Dragonflies and Damselflies of New Guinea, Maluku, and the Solomon Islands”, is down to the last few copies of this book, and once they are all gone, they’re gone forever, as there are no plans for a reprint. If you would like a copy, the price is \$75.00 USD postpaid. You can obtain yours by e-mailing John at <huonia@aol.com>. John further notes “Author’s inscription, if requested, does not decrease the value noticeably”!

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 from those who are discovering odonates this year or who have pursued them for decades, there are plenty of interesting, entertaining, and inspiring stories out there to be told!

Filling in the dots in Alabama, by Karen Chiasson
<kchiasson74@yahoo.com>

I have been an avid birder since 2000, but it was not until 2015 that I became interested in photographing odes. While on a birding trip to Trinidad I noticed a man who put more emphasis on locating and photographing odes than birds, and I was intrigued. When we arrived home, I looked at his photos of the odes of Trinidad and thought “look what I missed!” That’s when I got hooked into the world of odes.

Here in Baldwin County, Alabama in the late spring/summer months there are not many birds to photograph because they are nesting and high in the canopy. Photographing odes is a hobby that keeps me outdoors, which is where I love to be. I ordered a couple of ode books and noticed there was no mention of the flight times for the state of Alabama. Because of this and the lack of data on Odonata Central (i.e., specific locations), I set out to document species, dates, and locations for Baldwin County, and nearby Mobile County whenever I am over that way.

I started visiting the sites on my birding routes and began to document the odes I came across. I found several lifers just by stopping at every bridge I came across. So, whether I’m out birding or photographing other insects, I still keep



Band-winged Dragonlet (*Erythrodiplax umbrata*) male, Baldwin County, Alabama, September 2015.

my eye out for odes. I think the highest number of ode species is from one of my favorite haunts for birding, Fairhope Falls. This subdivision was an undeveloped piece of property which I have frequented



Red-tailed Pennant (*Brachymesia furcata*) male, Baldwin County, Alabama, September 2015.



Gray Petaltail (*Tachopteryx thoreyi*), Baldwin County, Alabama, March 2017.

since 2009. Within 3.5 years I had tallied over 130 species of birds for this one area. Unfortunately, late last year they started developing the property, but I still visit to see what I can find, which is how I came across a perched *Somatochlora filosa* (Fine-lined Emerald).

Since becoming interested in odes, I realized some can’t be ID’d without taking a closer look, so I ordered a net. In my first attempt to net a darner, I swiped at it and the top part of my net disconnected from the handle. I couldn’t stop laughing! But guess what? That *Nasiaeschna pentacantha* (Cyano Darner) was captured! And I would have never found my lifer *Arigomphus maxwelli* (Bayou Clubtail) if my husband had not bought a trolling motor for our small boat just so we could visit those hard to get to areas.

Yes, I’m hooked. I am very much still a novice at this, but I still have the interest to seek out more. I have not yet found 16 of the documented species for Baldwin County; thus, my goal for 2018 is to try and find these and other undocumented species that should be in my neck of the woods. Wish me luck!



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.

In this instalment, Jim Lemon shares a colorful Comet Darner (*Anax longipes*) that he caught on the wing last summer.

Shooting a Comet, by Jim Lemon <jlem@rwoh.rr.com>

This image was captured when I was at Lake Wood Duck, one of the smaller lakes at the La Su An Wildlife Area, just after noon on Sunday 2 July 2017. It was a brilliantly sunny summer day with many odonates flying, including several pairs of Comet Darners (*Anax longipes*). Females were flying up and down in the cattails ovipositing, while the males were very focused on guarding behavior. A light breeze from the southwest kept the males somewhat in place; this was a contrast to my normal “Comet” experience, which is just seeing a blur as they zoom past. I was able to make several acceptable aerial shots, and this image was the most in-focus. I really like this combination of red, green and blue.



Comet Darner (*Anax longipes*) male, La Su An Wildlife Area, Williams County, Ohio, 2 July 2017. Photo by Jim Lemon.

Photo Submissions for ARGIA

Would you like to contribute a photo as a possible front or back cover “glamour shot” for ARGIA? We use high-quality images in TIFF or JPEG format with a resolution of at least 300 ppi at 6.5 inches in width. **Please check your image resolution before sending!** Photos of an interesting behavior or specimen may be suitable for Parting Shots if they have a resolution of 300 ppi at column width (3.2 inches).

Send your photos as e-mail attachments to <editor@dragonflysocietyamericas.org> (up to 15 Mb), via a file transfer service, GoogleDrive, or Dropbox, **NOT in the body of an e-mail or document!** Photos may be kept for use in later issues, but they will never be used for purposes other than ARGIA, and the copyright is retained by the photographer. Please include date, location (state and county at minimum), and photographer’s name for each photograph.

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.getName/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) *Hagenia brevistylus* (Dragonhunter) at an ATV trail crossing of the Popple River, Forest County, Wisconsin, 30 June 2017. Photo by Kurt Huebner. (lower) Williamson's Emerald (*Somatochlora williamsoni*) male, Door County, Wisconsin, July 2017. Photo by Jim Burns.

