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Front cover: "Dragonfly Yoga", male Amanda's Pennant (*Celithemis amanda*), Ates Creek at fish hatchery west of Crestview, Santa Rosa County, Florida, 11 July 2009. Photo by Dennis Paulson.

Louie! Louie! Louisiana!

Jerrell J. Daigle <jdaigle@nettally.com>

It was a very successful 2016 SE DSA regional meeting held in Alexandria, Louisiana, hosted by our industrious Bill Mauffray, who lived in Louisiana for many years. A group of 30 people from Alabama, Colorado, Florida, Illinois, Louisiana, New York, North Carolina, Tennessee, and Texas attended the main meeting from 31 March–3 April, and another smaller group went on the post-trip to Bogalusa. We saw the endangered target species *Cordulegaster sarracenia* (Sarracenia Spiketail) in pitcher plant bogs along with *Argia bipunctulata* (Seepage Dancer). We found the regional endemic *Gomphus oklahomensis* (Oklahoma Clubtail) at places like Anderson Pond, and we also saw the rare Red-Cockaded Woodpecker.

John Abbott reports "We collected, took tissue samples from, and released a total of 19 adults and 22 nymphs of *C. sarracenia* from a site within the Kisatchie National Forest. An additional four adults and 19 nymphs were sampled and released from a site in the Angelina National Forest of east Texas. This is to better estimate effective population size and look at gene flow between populations. It was fun to show the participants of the SE DSA meeting this rare species and I appreciated everyone's concern for the sensitive habitat. A special thanks goes to Steve Shively (U.S. Forest Service) for his continued support with our work on *C. sarracenia*."

Ophiogomphus australis (Southern Snaketail). Photo by Steven Daniel.

Cordulegaster sarracenia (Sarracenia Spiketail). Note the yellow dot on the wing for mark-recapture study. Photo by Tim Deering.

It would be interesting to see if we can find any *Cordulegaster* in pitcher plant bogs or steephead seepages in southern Mississippi and southern Alabama to see if there is any connection with the Florida and Georgia populations of *Cordulegaster sayi* (Say's Spiketail).

I would be remiss if I didn't mention the raucous dinner we had Saturday night at Tunk's Cypress Inn on the lake. Highlights included "fish in a bag", poorboys, and the local favorite of crawdads! All in all, we had a great time and we want to thank our host, Bill Mauffray, for putting on a great meeting. Good job, Bill!

As for the Bogalusa post-trip, we were successful in seeing the springtime target species *Ophiogomphus australis* (Southern

continued next page...

Calendar of Events

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

Event	Date	Location	Contact
DSA Annual Meeting	15–17 July, 2016	Provo, Utah	Alan Myrup <alanmy@comcast.net>
Int. Congress of Entomology	25–30 Sept. 2016	Orlando, Florida	S. Büsse <sbuesse@zoologie.uni-kiel.de>

continued from previous page...
Snaketail), *Gomphus apoymius* (Banner Clubtail), and *G. hybridus* (Cocoa Clubtail). The water levels were normal, but there was detrimental dredging of gravel bars where wooden bridges were replaced. We had some very good photographers at this meeting and I have included several photos from Tim Deering, Richard Yank, and Steven Daniel.

Next year, we hope to have the SE regional meeting somewhere in central Georgia in late spring. As more details become available, please keep checking the DSA website and ARGIA for more information. We hope to see you there!

Gomphus hybridus (Cocoa Clubtail). Photo by Richard Yank.

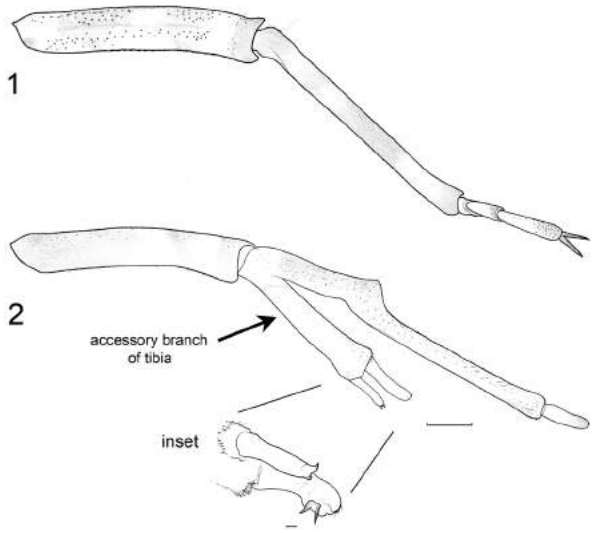
Gomphus apomyius (Banner Clubtail). Photo by Richard Yank.

The SE DSA participants heading out to the field, Kisatchee National Forest. Photo by Richard Yank.

Edward Scissorhands is Back, *Aeshna* Style

Ken Tennessen <ktennessen@centurytel.net>

I have examined hundreds of exuviae and nymphs of *Aeshna* (Mosaic Darners) in my various research pursuits, and while I've stumbled upon small, sometimes interesting abnormalities on occasion, recently I ran across a nymph of *Aeshna palmata* (Paddle-tailed Darner) from a pond in Marion County, Oregon that has a spectacular malformation. I think the specimen deserves documenting, mainly because the left mesothoracic (middle) leg has a bifurcated tibia! The dorsal branch is over 20% longer than a normal tibia, there is a bend in the proximal third, and its stunted tarsus is one-segmented with extremely small apical claws (Fig. 2; Table 1). A ventral arm (or accessory branch) splits from the base of the dorsal branch—it is short (about 3.3 mm long) with a wide apex and has two malformed tarsi. Each branch of the double tarsus on this accessory tibial arm is one-segmented and has short claws, the larger pair being about 40% the size of normal claws, the smaller pair about half that (as seen in ventral view, inset in Fig. 2); the two sets of claws are oriented in different directions. The femur is nearly normal, although it apex is slightly reduced and its articulation with the base of the tibia is stiff. I know of no similar abnormality having been reported in the literature.



Figures 1–2. Mesothoracic legs of *Aeshna palmata*, left lateral view (based on specimens from Marion County, Oregon): 1) normal femur, tibia, and tarsus; 2) malformed tibia and tarsus; inset = enlarged, ventral view of tarsi of accessory branch.

For comparison, a normal leg with three tarsal segments is shown in Fig. 1, this one from a different specimen taken on the same day at the same locality. Both specimens were F-0 females. Getting back to the abnormal specimen, the right mesothoracic leg has a typical-looking femur, but the tibia is so stunted that it is merely a rounded-off stub; there is no tarsus. The prothoracic and metathoracic legs appear normal, as does the rest of the nymph's anatomy. The nymph was nearing maturation, as the adult eyes are nearly fully-formed underneath the cuticle of the occiput, and the adult wing venation can be seen under the cuticle of the wing pads.

As to what caused these leg malformations, I can offer speculation only. An injury in an earlier instar is one possible cause, although it seems odd that both middle legs would have been affected while the other legs were not. And it is hard to imagine that an injury could cause a bifurcation of a tibia—would it not regenerate to a single tibial joint? In my opinion, it seems more plausible that the malformations are due to some genetic or intrinsic developmental defect. The pond from which the *A. palmata* specimens were taken is not known to have been polluted. The malformed nymph apparently was able to feed and avoid predation, so it probably would have been able to emerge to the adult stage, that is, if Jim Johnson had not appeared at its habitat one day, untimely for it, but timely for us.

I thank Jim Johnson for allowing me to examine, illustrate and report on these specimens of *Aeshna palmata* and for donating the malformed specimen to the Florida State Collection of Arthropods.

Table 1. Size comparison (mm) of the left mesothoracic leg of two nymphs of *Aeshna palmata* (#1 with normal legs, # 2 with malformed middle legs) collected in Marion County, Oregon, 13 July 2012.

Specimen	Femur L	Tibia L	Tars1 L	Tars2 L	Tars3 L	Claw L
#1 (normal)	5.65	5.85	0.24	0.83	1.24	0.71
#2 (malformed)	5.50	7.25	1.03	—	—	0.02, 0.05

A Spectacular Event: Six Emergences of *Neurocordulia michaeli* Brunelle (Broad-tailed Shadowdragon) in a Home on 25 and 26 November, 2015

Raymond Hutchinson <raymond.hutchinson@sympatico.ca> **and Benoît Ménard** <benoitmenard1965@hotmail.com>

The authors of this note have undertaken a research project spread over two or three years (2015 to 2017) to accumulate data on the life history of *Neurocordulia yamaskanensis* (Stygian Shadowdragon) and *N. michaeli* (Broad-tailed Shadowdragon), two species recorded for the province of Quebec, Canada. The specific geographical areas covered are the Outaouais region in the province of Quebec, and the Petawawa River in the province of Ontario, Canada. They have not yet found *N. michaeli* in the Outaouais, but must travel to Petawawa to conduct field work and gather information and scientific data on this species.

In the environs of Gatineau over a radius of about 50 km, exuviae of *N. yamaskanensis* can be collected by the hundreds, especially on the shores of the Ottawa River and also at Lake Jean-Venne, north of the municipality of Ste-Cécile-de-Masham. This site affords us the opportunity to collect and observe many adults of this crepuscular species and to find numerous exuviae, but we have found only two larvae over a period of 25 years.

Our main objectives are threefold: first, to pinpoint the exact habitat and microhabitats of neurocordulid larvae; second, to obtain emergences at home of mature larvae and photograph cleaned larvae, exuviae, and adults; and finally, to hopefully acquire a better knowledge of the total life history of these fascinating dragonflies, especially in the larval stage.

On 1 June 2015, we organized a field trip to the town of Petawawa (Ontario). The participants were RH, BM, his daughter Sophie, and his nephew Daniel. We were only able to collect one larva of *N. michaeli* and two of *N. yamaskanensis*. The almost torrential currents of the river, owing to the seasonal melting of snow, made it very difficult to work efficiently.

Ottawa River near Petawawa, Ontario, habitat for *Neurocordulia*.

Larva of *Neurocordulia michaeli* (Broad-tailed Shadowdragon).

Teneral female *Neurocordulia michaeli*.

However, at the end of the season, on 12 October 2015, BM, his wife Line, and his daughter Sophie, returned to collect *Neurocordulia* larvae at approximately the same spots as in the spring. It was a memorable day. During about an hour and a half, they collected 34 larvae of *N. michaeli*, almost exclusively. Ten specimens were close to maturity and 24 were of small to medium size. The collecting method consisted of lifting submerged stones to fetch the larvae clinging steadfastly to them. The stones were about the size of a human hand and were found under moderate current waters of the Petawawa River.

At his home, BM fed the larvae with mosquito larvae and pupae, small amphipods of the gammarid type, and other small aquatic organisms harder to find at the end of the season. The *N. michaeli* larvae obviously adapted rather well to

their new, artificial "micro-environment", considering that six individuals (three males and three females) emerged on 25 and 26 November 2015 (see photographs).

These attempts over two to three years (2015 to 2017) at rearing wild-caught *Neurocrodulia* larvae at home are part of a research project on neurocordulids by the authors. Among the salient features of these initiatives are the desire to partially rear larvae at home or in a lab, away from the wild realm of these creatures with the following goals: 1. discovering the best "foods" or prey that the larvae prefer; and 2. attempting to take wonderful pictures of cleaned as well as uncleaned live specimens in the hope of finding new morphological characters, if possible.

As a side note, the larvae can be manipulated and cleaned with an artist paint brush securely and without damage when handled correctly.

We thus hope to have new data to report following our 2016 field trips searching for *Neurocordulia yamaskanensis* and *N. michaeli*.

Newly-emerged female *Neurocordulia michaeli*, with exuvia at upper right.

The Rewards of Collecting and Rearing Nymphs

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As dragonflies and damselflies are becoming increasingly popular with nature enthusiasts in North America, more attention is also being drawn to their nymphs. After all, odonates spend most of their lives underwater, and that "hidden" part of their development lures many of us to them. Searching for their veiled underwater habitats is a captivating and never-ending challenge, and watching them feed and move about is fascinating. So learning about odonate nymphs can be seen as a "value-added" way for dragonfly enthusiasts to further enrich what is already a wonderful obsession. Strong attendances when we've led workshops on nymph identification in recent years are evidence of a growing interest in nymphs. NymphFest 2016, which was held this past March in Bennington, Vermont, was well-attended.

Learning how to identify nymphs is a big part of learning about them. Identification involves using a dichotomous key and typically requires a stereomicroscope, light source, and other tools, all of which can be expensive. The learning curve for nymph identification can be steep because names of body parts must be learned and character states can sometimes be challenging to understand. Good illustrations of key body parts are a big help, so the best keys are liberally and clearly illustrated. But it is unrealistic to think that every body part that would be helpful to see will be illustrated in any given key, and some keys have illustrations that are not the best. The picture we've just painted—expensive keys and tools, keys that need improvement, much jargon to learn, illustrations that are sometimes inadequate—might look rather grim. These sobering realities have probably discouraged many from full-heartedly embracing nymphs. But there is light at the end of the tunnel—how valuable it would be to have in your possession a known nymph or exuvia of the species you are trying to identify! You could examine it next to your unknown specimen, side by side in the same petri dish, and compare them character by character. Even better, imagine how enormously helpful it would be to have known nymphs or exuviae of all of the closely related species in the group you are studying! In this

way you would be ideally positioned to identify unknown nymphs. You would key them out in conventional fashion to arrive at tentative determinations, then compare them with reared exuviae and known nymphs of that and similar species to confirm your determinations.

Acquiring known exuviae takes some time and effort, but it is a readily achievable goal, and you'll have tons of fun in the process. Here's the basic idea. If you collect a fully mature nymph (a.k.a. final instar or stadium; F-0) and allow it to emerge in captivity, the new teneral adult is relatively easy to identify, assuming you give it a few days to harden and gain some color. That means you now know the identity of the exuvia it came out of with a high degree of certainty. Of course, it is always possible that you could have misidentified the teneral, but if you've been careful with that identification, you are now the proud owner of a known exuvia of that species! Once the exuvia has been carefully labeled with the date, location, species, and determiner, you could then release the teneral. Alternatively, you could preserve the teneral and store it and the exuvia together in alcohol (or store them separately, but link them with an identifying code). If you plan on referring to the specimen in a publication, then you should probably retain the teneral.

An extension of this process can help you to obtain firmly determined nymphs as well. The basic idea is that you could collect from a single site a number of mature nymphs that look like the same species. You would then rear a portion of them and preserve the rest in alcohol. If the reared ones all turn out to be the same species upon emergence, then there is a good chance that at least some of the preserved nymphs are that species too. You would then confirm the identification by examining the nymphs under a microscope to see if some of them key out to that species, and compare them to the reared exuviae to see if they have the same diagnostic characters.

Here is a step by step guide to the collecting and rearing process:

Knowing a good breeding site for the species you want to study is a good way to find nymphs. Seeing adults of your target species during a previous year is a good indication of a breeding site, especially if you saw reproductive behaviors (pairs in wheel, in tandem, females ovipositing). This doesn't guarantee a good breeding site because adults disperse widely and females sometimes oviposit in inappropriate habitats, but at least you will have a good place to begin looking for nymphs. Check flight charts in field guides or online resources to find out when your species is likely to begin emerging. You can then visit the site a week or two before emergence is likely to begin and try to collect some full-grown nymphs with a dip net. You don't want to collect the nymphs too early in the season because they

Figure 1. Nets used by Bob for collecting nymphs: (L) smelt net; (R) small fish dip net.

Figure 2. Two nets constructed by Ken for collecting nymphs.

might not be F-0, which means you would have to feed them, probably for months. If feeding is necessary you can order black worms (*Lumbriculus*) from a biological supply house and feed them to your nymphs with a pipette, or you can go out and collect prey for nymphs, such as mosquito larvae or other small insects, with a small dip net in ditches or other shallow waters near where you live.

However, while feeding younger nymphs is fun and instructional, it also lengthens and complicates the rearing process. Our focus in this note is on collecting and rearing full-grown nymphs. Full-grown nymphs of North American Anisoptera can be identified by their long hindwing pads, which are as long as or longer than the width of the head (KT, unpublished data). If your vision is good, you'll be able to see these dimensions by looking closely at the nymph in dorsal view. Using a 10X hand lens can be a big help but might not be necessary. If the hind wing pads are noticeably shorter than the head is wide, then the nymph is not full-grown (<F-0) and still has to molt at least once. If the wing pads are swollen, then you've hit the jackpot because the nymph is likely to emerge within a few days.

Any aquatic dip net can be used to collect nymphs, but nets with larger mesh sizes, of about 1/8 inch or even a bit larger, are easier and quicker to use than nets with finer mesh because fine mesh retains more sediment and vegetative debris. Bob prefers to use nets designed to dip for American smelt (*Osmerus mordax*), which have mesh openings of about 3/16 inch (Fig. 1, left). If the habitats to be sampled or the nymphs to be collected are too small for that net to be used, then he uses a smaller dip net (designed to transfer fish) that has a slightly finer mesh (Fig. 1, right). Ken designs and builds his own dip nets in a variety of sizes and shapes for various applications (Fig. 2). Homemade dip nets can be designed for specific purposes (e.g. Hutchinson and Ménard, 2015). Online searches using the words "aquatic dip net" or "smelt net" will return a plethora of net options for purchase in every conceivable size, shape, and price. Bear in mind that you need a durable net (lots of pointy sticks and roots down there) and that the mesh size should be no smaller than needed to retain nymphs of the size you'll be targeting.

Nymphs can be reared indoors in any escape-proof container that can hold some water and in which an emergence support is provided. Most simply, a number of nymphs can be placed in a covered aquarium (any size) containing a few inches of water and in which sticks have been leaned against the glass so the nymphs have something to crawl out of the water onto. However, a problem with a communal rearing operation is that if a number of nymphs emerge at about the same time it can be tricky to associate the tenerals with their proper exuviae, which is something

Figure 3. A 16 oz. beverage cup used as a rearing container.

you do not want to get confused. Imagine waking up in the morning and checking your container to see that two or more species emerged from your nymphs—and you don't know which ones came from which exuviae! The effort you expended would be wasted. Individual rearing cups solve this problem and take up less room. Clear plastic containers are excellent for rearing because they allow you to easily see what is transpiring inside (Tennessen, 2014). In a pinch, any cup or container can be used, as long as an emergence support (stick or piece of screen) is placed inside and the top is covered with screening or netting (Fig. 3). Make sure that the rearing container is large enough to comfortably hold a dragonfly of the size you are planning to rear.

One other warning: after the dragonfly has emerged, you should gently pour off the water remaining in the cup. If you don't do so it is likely that sooner or later (probably sooner) the dragonfly will fall into the water and drown; if this happens shortly after emergence, you might not be able to identify the adult. Since emergence often occurs during the early morning hours, you should check your rearing containers soon after you arise and then as frequently during the day as you can.

Exuviae should be clearly labeled using pencil or water- and alcohol-proof ink on slips of good quality paper as soon after emergence as feasible. They can be stored in shell vials or other small, tightly sealed containers. Exuviae are easier to work with for taxonomic purposes if wet as they are then less brittle. We store exuviae in 80% ethanol (i.e., ethyl alcohol) as we do nymphs, but exuviae can be stored in a weaker alcohol solution (>50%) as long as the immature adult is not included. Isopropyl alcohol (rubbing alcohol that can be purchased in any drug store) can be substituted for ethanol. If the immature adult is to be stored in the same vial as the exuvia, use 80% alcohol. Be careful when identifying the immature adult because successful rearing obviously hinges

on this being done correctly. Allow the teneral enough time to harden and for the color patterns to become established before you try to identify it, especially if it will be soaked in acetone then stored separately. If you plan to release the immature adult it is best to do so near the waterbody where you caught the nymph.

A short-cut version of the rearing process is to collect teneral/exuviae associations as they occur in the field. During times of peak emergence, you can often find these associations on bank areas, especially if you visit them in the morning. The basic idea is that you carefully place the association in a small cage and allow completion of emergence and hardening of the teneral to occur in captivity. We use a pair of old scissors to gently cut the stem or blade of grass that the association is on, and then carefully place it in a cage. Bob enjoys making his own cages out of beverage containers (Fig. 4), but any small cage will work. The exuvia is then preserved in alcohol and the teneral is either preserved or released as is done when the nymph is reared in captivity.

There are several points to bear in mind when collecting associations in the field. The most important is that you are certain the exuvia and teneral are correctly associated. It can be tempting to make the assumption of association when you find a teneral and exuvia in close proximity, but do so with much caution because the teneral might have moved since it emerged and might be closer to an exuvia other than its own when you find it. Making an incorrect assumption of association is most likely when there is a high density of emerging tenerals. It is safest to collect the association after you watched it happen (but before the teneral flies off!). We have also had good success by finding and retaining nymphs just before emergence while they were on or approaching their emergence supports. Be sure that nymphs have enough space around them in the cage to safely emerge and that you don't jostle them while emerging, as this is a physiologically sensitive period.

In sum, rearing not only provides you with valuable reference exuviae, it is fun and educational from start to finish. Because the process is an active one, it is a great way to learn and to retain what you've learned!

Figure 4. Rearing cage constructed a ½ gallon beverage container and window screening.

References

Hutchinson, R. and B. Ménard. 2015. Collecting the tiny larvae of *Nannothemis bella* (Uhler) (Odonata: Libellulidae), Elfin Skimmer, in the Province of Quebec, Canada. Argia 27(2): 12-13.

Tennessen, K. 2014. Fashioning small individual containers for rearing Odonata. Argia 26(1): 29.

Request for Proposals to Host a Southeastern DSA Regional Meeting

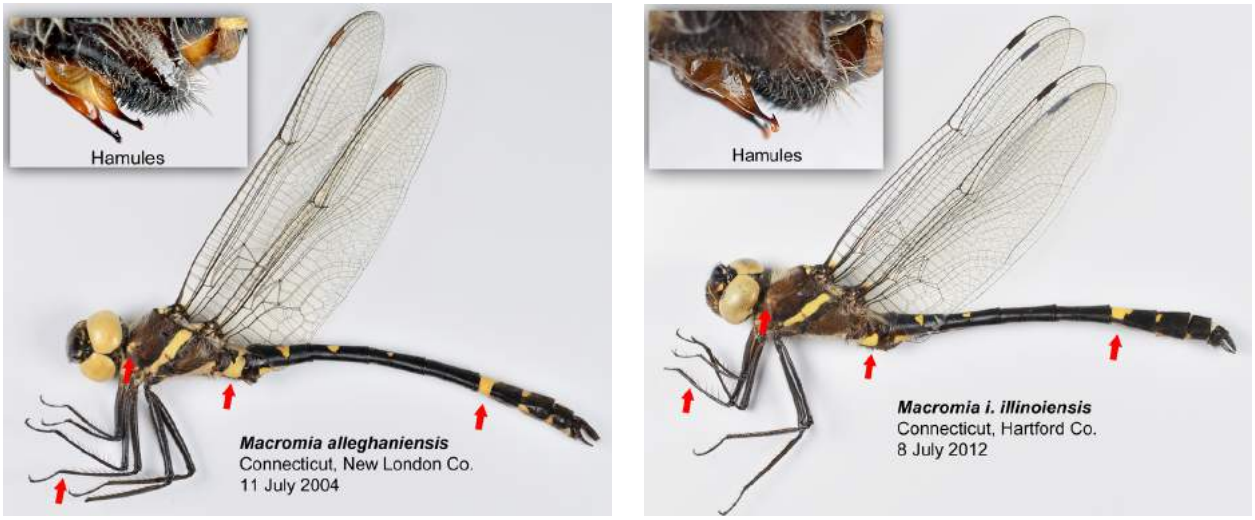
Aloha! I am looking for proposals to host a future southeastern DSA regional meeting. If you would like to host a meeting in 2018, 2019, or 2020, please let me know. If you have any questions, please contact me at <jdaigle@nettally.com>. Thanks! Talk to me later—aloha nui!

Jerrell J. Daigle

Discovery of Allegheny River Cruiser (*Macromia alleghaniensis*) in Rhode Island and Connecticut

Ginger Brown <vbrown@fullchannel.net> **and Mike Thomas** <mikethomas206@comcast.net>

In recent reviews of collected material, we have discovered numerous records in Rhode Island and Connecticut of the Allegheny River Cruiser (*Macromia alleghaniensis*), which we believe to be the first records of this species in New England. It appears this species has been present in southern New England for quite some time. Specimens are known from two counties in Connecticut (New London, Windham) and two counties in Rhode Island (Washington, Kent). All of these counties are in the southern parts of the two states, including areas along or near the Rhode Island-Connecticut border. Specimen records are known from as far back as 1999. Some of these are vouchers that were incorrectly attributed to Illinois River Cruiser (*Macromia illinoiensis illinoiensis*). Recent collections of *M. alleghaniensis* in southeastern Connecticut were made in July 2015 by Valinn Ranelli. All specimens are from rivers and streams or in the vicinity of lotic habitat, and some locations have both river cruiser species present. Field surveys will be conducted this summer to determine the current status of *M. alleghaniensis* in Rhode Island and Connecticut, and we encourage others to look for this species in neighboring states. We thank Ken Tennessen and Steve Krotzer for their assistance in examining specimen photos and for confirming the species determination.



Comparison of males of *Macromia alleghaniensis* (Allegheny River Cruiser, L) and *Macromia illinoiensis illinoiensis* (Illinois River Cruiser, R), both specimens from Connecticut, showing distinguishing characteristics. In *M. allgehensiensis*, note the yellow ring completely encircling S7, short mesotibial keels, nearly continuous yellow ring on the sides of S2, and the hamules.

Call for Papers for BAO

The Bulletin of American Odonatology needs your manuscript submissions to help us keep BAO a vehicle for timely reporting of research on Odonata of the New World. BAO addresses a wide range of topics, including faunal synopses, behavioral analyses, and ecological studies. If you have questions about the guidelines for publishing in BAO, see the last page of this issue of Argia or contact Steve Hummel, BAO Editor, at <editor@dragonflysocietyamericas.org>.

Male-male Interactions in Darners

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

Cranberry Lake in Anacortes, Washington (Figure 1) is a wonderful place to observe dragonflies—especially darners. The first species to start flying is the California Darner (*Rhionaeschna californica*), followed in short order by the Blue-eyed Darner (*R. multicolor*). Later in the season, in October and November, the darner population shifts to Paddle-tailed Darners (*Aeshna palmata*), with a few Shadow Darners (*A. umbrosa*) tossed in for good measure. As a result, Cranberry Lake is an excellent place to observe darner behavior throughout the flight season

Figure 1. Cranberry Lake, home to many darners.

Over the years, it has become apparent that the way darners interact with one another evolves as the season progresses. Early in the season, darners fly in mixed flocks, though comprised mostly of males, at convenient hill-topping locations, where the individuals hunt for prey peacefully with little interaction (see the online video links at the end of this article). This is the time when the darners are feeding to attain maturity, after which they return to nearby ponds or lakes to mate.

As the season progresses and more and more darners are present at local waters, the interactions begin in earnest. In what follows, I describe the types of interactions and the changes in behavior observed at Cranberry Lake, both during the peak of the season and extending well into the final days of flight.

Peak Season Interactions

Interactions during the peak of the season are observed to be rather benign and, one might almost say, gentlemanly. Darners patrol the shoreline of their territory, looking for rivals, mates, and prey. When a second darner flies into the territory of a resident darner, the resident flies toward the intruder. Typically, what happens next is a respectful assessment of the situation, in which the intruder changes course to navigate out of the disputed territory. Once the resident darner observes the change in trajectory of the intruder, it changes course as well, and returns to its territory.

As mentioned, these interactions are usually peaceful affairs, with no physical contact between the competing darners. The darners approach to within a few feet of one another, veer off as they change course, and go their separate ways. As the season progresses, however, the situation changes.

Late Season Non-Contact Interactions

Late in the season, when the days are growing shorter, the air is getting cooler, and the biological imperative to mate is intensifying, the interactions between darners take a decidedly aggressive turn. The first signs of change are apparent in the way a resident darner interacts with an intruder. Often we see that instead of veering away from the intruder once the intruder is heading out of the territory, the resident keeps up a prolonged chase, though again, generally without physical contact.

In such cases, I've observed the resident male persist in chasing the intruder to an extent that seems, to a human observer, beyond all reason. Even though the intruder is clearly departing the area, and seems no longer to pose a threat, the resident darner expends a great deal of energy and time in an extended chase.

Sometimes, the intruder is so pressured by the resident that its wings clip the water as it zigs and zags trying to escape. In other occasions, the intruder intentionally plunges into the water in a splash/dunk (Walker, 2011–2014, and online video), and then, as the pursuing resident continues on its course, the intruder emerges from the water and takes off in the opposite direction. Clearly, drastic circumstances result in drastic measures.

The aggressive harassment described above still results in no physical contact. Cases that do involve contact become more and more common as the season progresses.

Late Season Contact Interactions: The Final Days of Flight

As the end of the flight season approaches, the interac-

tions between darners become more frequent, and more physical. Males are seen to attempt to attach in tandem with other males, and to grapple with one another in flight for extended periods of time. The whole tenor of their interactions changes.

The first sign of contact interactions is observed in perched darners. Even though darners are flying dragonflies, they do perch from time to time to rest, eat large prey, or sunbathe. They hang vertically in bushes with full exposure to the sun (Figure 2). It's common to find three or four darners perched at a time in the bushes near the shore of Cranberry Lake in peak season, but the number roughly doubles or triples near the end of the season, as more darners seek to warm themselves in the sun.

In late season, there may be a dozen darners perched in the bushes, but still with plenty of room to accommodate all of them. Even so, they are often seen perched near one another (Figure 3). What's really odd, though, is that a darner coming in to perch often lands on an already perched darner. Close observation reveals that the incoming darner lands on the thorax of the perched darner, and bends its abdomen downward and forward in an apparent attempt to attach in tandem. At this point the perched darner takes off, and the two darners continue their interaction in flight.

At the same time, many in-flight interactions can be seen along the shoreline. Competing darners no longer veer off in different directions or engage in extended pursuits, but aggressively grab one another in flight. In some cases I've captured in slow-motion videos (see online videos), the two darners hang on to one another and spin round and round in flight—much as two eagles locked together with their talons. In one particular case, they grapple with one another for 1.9 seconds as they fall toward the water, only releasing their grip just before splashdown. They gain altitude for 0.75 seconds, and then go back at one another, clenching for another 2.3 seconds, before taking off for more interactions.

Figure 2. A perched Paddle-tailed Darner (*Aeshna palmata*) at Cranberry Lake in its usual vertical orientation.

Figure 3. A Shadow Darner (*Aeshna umbrosa*; L) and a Paddle-tailed Darner (*A. palmata*; R) perch near one another.

In another case, the two darners actually landed in the water as they struggled. While floating there, the top male repeated banged the tip of its abdomen against the head of the darner below it for over 4.5 seconds, as it tried mightily to attach in tandem. It finally gave up, flew upward to gain altitude, and 0.9 seconds later the other darner managed to escape the water as well. Interactions like this were common at this time of year.

These observations are only anecdotal, and may not present an accurate picture of darner behavior throughout a season. Additional observations will form a more complete picture, but so far it seems that darner interactions are much more aggressive and physical late in the season, when the darners only have days left to fly.

Conclusion

Darners interact with one another frequently all year long, but their interactions become more intense and physical in the waning days of their flight season. Males land on

one another, or grab one another in flight, and appear to attempt attachment in tandem. Late season interactions lead to explosive events at Cranberry Lake in October and November, and likely the same type of behavior can be observed at any location with a healthy darner population.

Acknowledgements

I would like to thank Betsy Walker for her support and help with these observations.

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Online Video Links

Slow-motion videos showing various aspects of dragonfly behavior can be found on The Dragonfly Whisperer channel on YouTube. Here are a few pertinent to this article:

Soaring Darners with Mount Baker <https://www.youtube.com/watch?v=ooeBaJ0SCaM> (non-interacting darners in a feeding group).
Darners interact <https://www.youtube.com/watch?v=nZOaVuwea_I> (gentle, non-contact interaction with zig-zag flight).
Darners interact with splash-dunk escape <https://www.youtube.com/watch?v=AiCCckpjgA4> (non-contact chasing; pursued darner escapes with a splash-dunk).
Darners grab one another and fall in the water <https://www.youtube.com/watch?v=I7oEJ9P4Kko> (contact interaction; darners hold on to one another until they hit the water).
Male darners interact big time, <https://www.youtube.com/watch?v=9UVUxjbhYA0> (extended contact interaction).
Male darners struggle in water <https://www.youtube.com/watch?v=ng-oLCD3cEI> (males struggling in the water as one attempts to attach to the other).

Odes of St. Croix—Fredding with Fred in Frederiksted!

Fred Sibley <fcsibley@empacc.net> **and Jerrell J. Daigle** <jdaigle@nettally.com>

In September 2015, George and Phoebe Harp and Jerrell J. Daigle surveyed St. Croix in the U.S. Virgin Islands for odonates. They compiled a list of 12 species for the island (see Argia 27(4): 21–22, 2015) from ponds in the northeast portion of island and the canal at Frederiksted on the west end of island. In February 2016, Jerrell J. Daigle and Fred Sibley spent a week surveying ponds and streams from their base at the Frederiksted Hotel in Frederiksted. Eighteen species were recorded, including all the species recorded on the previous trip. The new list consists of 18 species, with four new records for St. Croix and one new record for the U.S. Virgin Islands.

St. Croix is recovering from three years of drought, so ponds were low and the three permanent streams were probably shorter than in a wet year. We had plotted potential ponds from GoogleEarth before arriving, but the images were from 2006 and there have been many changes since, making it somewhat difficult to find ponds. Our original plans to cover the island were overly optimistic and we ended up visiting only a dozen ponds, mostly on the western half of island. Lisa Ynterma, a local birder and the pond guru of St. Croix, informed us we had only 110 more to check. She was equally helpful in explaining access to the three permanent streams on the island: Mahogany Creek, Creque Creek, and Caledonia Valley. The first two parallel Highway 76 and Highway 58 respectively, while the latter requires a 30–40 minute walk up the stream bed, with the last five minutes having water and a series of waterfalls. The typical pond is human-made, relatively small, formerly for livestock but now abandoned. About half of these were surrounded by a dense growth of thorny brush and small trees and partially to totally overgrown with aquatic vegetation. Although often close to a road they were usually not visible from the road and access was difficult. Jerrell comments "Acacia trees and mesquite brush ringed the ponds and inch-long thorns kept me


Representative image of *Dythemis rufinervis*, San Juan, Puerto Rico, 26 May 2007, OC record 284630. Photo by William Hull.

from working my way through to one of the best ponds."

Jerrell claims we blitzed the island and recorded all the resident species; Fred is more hesitant. *Pantala hymenaea* (Spot-winged Glider), *Tramea calverti* (Striped Saddlebags), and *T. onusta* (Red Saddlebags) will certainly show up in wet and/or invasion years. *Telebasis* (firetails), *Anax junius* (Common Green Darner), *Anax ephippiger* (Vagrant Emperor), and probably many others are possible as accidentals. Knowing the vagaries of island colonization and extinction, additional species might establish populations on St. Croix. Since several species were found at only one locality, it is possible we missed a unique pond or stream section with additional species.

Species List for St. Croix, February 2016

Ten of the 18 species are common and likely on any pond although not found on every pond: *Ischnura ramburii* (Rambur's Forktail), *Brachymesia furcata* (Red-tailed Pennant), *B. herbida* (Tawny pennant), *Erythemis vesiculosa* (Great Pondhawk), *Erythrodiplax umbrata* (Band-winged Dragonlet), *Orthemis macrostigma* (Antillean Purple Skimmer), *O. schmidti* (Schmidt's Skimmer), *Perithemis domitia* (Slough Amberwing), *Pantala flavescens* (Wandering Glider), and *Tramea abdominalis* (Vermilion Saddlebags). The others are rare or habitat restricted or both.

The island list is now at 18 species, with four new species (*) recorded for St. Croix; one of them new to the Virgin Islands(**).

**Enallagma coecum* (Antillean Bluet). Only found in the Caledonia Valley stream and rare there.

Lestes forficula (Rainpool Spreadwing). Only found at Creque Dam, Cane Pond, and Subway Pond but common at the former locality.

***Ischnura hastata* (Citrine Forktail). Only found at Cane Pond but abundant there. New for the U.S. Virgin Islands.

Ischnura ramburii (Rambur's Forktail). Abundant; found at almost every locality although less common in stream situations.

**Brachymesia furcata* (Red-tailed Pennant). Widespread but only a few at any one locality.

B. herbida (Tawny Pennant). Widespread and common at many ponds.

Dythemis rufinervis (Papyrus Setwing). Only found in Mahogany Creek and Caledonia Valley Creek, rare at both locations.

Erythemis vesiculosa (Great Pondhawk). Present at most ponds and fairly common.

Erythrodiplax berenice (Seaside Dragonlet). A brackish water species and very common at Great Pond, the largest mangrove area on island.

E. umbrata (Band-winged Dragonlet). More of a marsh species than pond species but easily found in these situations and abundant at one pond overgrown with aquatic plants.

Macrothemis celeno (Antillean Sylph). Very rare; one caught in Caledonia Valley stream and one more individual was seen there.

Miathyria marcella (Hyacinth Glider). A number seen over rough grassy area near Cane Pond and also seen on the September trip. Uncommon.

**Micrathyria didyma* (Three-striped Dasher). Found on Creque Dam stream (uncommon), Mahogany Creek (common), and Cane Pond (a few). These are respectively: a rocky forest stream with almost no herbacious vegetation; an open steam with lots of stream side vegetation; and a pond clogged with water lettuce.

Orthemis macrostigma (Antillean Purple Skimmer) and *O. schmidti* (Schmidt's Skimmer). Both species were present on most ponds and even on the streams. *Orthemis schmidti* outnumbered *O. macrostigma* 25 to 1 on the island, with rarely more than one *O. macrostigma* at a site. On trips to the Florida Keys, we found the difference in abundance changed with the seasons. This is something to check on St. Croix in the future.

Perithemis domitia (Slough Amberwing). Widespread on both ponds and streams but much more common on rocky stream bed pools.

Pantala flavescens (Wandering Glider). Widespread and not uncommon.

Tramea abdominalis (Vermilion Saddlebags). Widespread; possible at all localities. Not as numerous as *Orthemis* but common at ponds, rare in streams.

A few of the ponds were outstanding and seven of our 15 collecting sites, all localities where six or more species were recorded, are described below. Unique species are noted.

Caledonia Valley stream and waterfalls: Ten species (biased by few pond species in the rock quarry). This site is on the northwest corner of island and access is via a spur road off Hwy. 62. There is a large re-opened quarry at the base of the stream. You can park there and walk the stream bed on north side of the quarry to the waterfalls. It is a 30–40 minute walk on a rough, but marked, trail to the first falls. On the last five minutes of the hike there was water in the stream. At the time of our visit there were scattered pools in the rocky stream bed with less and less stream flow away from the falls. Sunlight was on the stream only from 11:30 am-1 pm and everything vanished after that. The stream is heavily shaded by the woods and there is a minimum of understory vegetation. Only site for *Enallagma coecum* and *Macrothemis celeno.* N 17° 45.740', W 64° 52.450', elevation 140 ft.

Creque Dam and stream: Eight species. An abandoned dam, originally built as water supply for Fredricksted but reported to us as never used. Dam is now cracked with slow leakage to stream below. There is a rather large stagnant pool behind it, but this was no more than knee-deep when we visited and had obviously been smaller and lower during the drought. Excellent site for *Lestes forficula*. Stream below dam is very similar to Caledonia Valley, with scattered pools along a rocky stream bed through woods with essentially no understory vegetation. N 17° 44.750', W 64° 52.590', elevation 230 ft.

Mahogany Creek: Seven species. A small spring-fed stream with some sections through woods and some open sections, but all with abundant herbaceous vegetation. Hwy. 76 parallels the stream, crossing the stream at a few places. Best site for *Dythemis rufinervis* (see photo) and *Micrathyria didyma*. N 17° 43.890', W 64° 51.683', elevation 180 ft.

La Grange Canal: Six species. Just north of Fredricksted, and at time of our visit just a narrow pond, 100 yards long and 10–15 feet wide, bordered by grass and small trees. N 17 °42.990', W64° 52.970', elevation 10 ft.

Cane Pond: Eight species. Just west of K-Mart (south side of Hwy. 70) and hidden by thorn brush barrier. Surroundings are otherwise highly manicured lawns (ask permission to access). This is a typical small pond, deep with steep banks. Vegetation had been removed at one end to create open water but rest mostly covered with *Pistia striolates* (water lettuce). Only site for *Ischnura hastata*. N 17° 42.265', W 64° 50.755', elevation 100 ft.

We were told the very large Fredensborg Pond had formerly been clogged with water lettuce but it had died off naturally (?).

Subway Pond: Nine species. Just west of the Subway shop on the north side of Hwy. 70. A little searching led us to a muddy path through the thorn scrub to the pond. We were then surprised to find the banks had been cleared back to maintain a wide grassy border around pond, which was free of aquatic vegetation except at the edge. N 17° 42.570', W 64° 50.370, elevation 130 ft.

This is Jerrell's favorite pond and ideal for "Fredding"—I made a swat net 10 ft. x 4 ft. by modifying a 25 mm mesh bird mist net (see photo) and attaching it to two 12 foot poles (two-foot sections of various weight and thickness so it can be packed in a suitcase). This is very effective on ponds with a minimum of vegetation or trash in the water. Almost all species will fly under it and a very quick swat will pancake them on the water.

Long Point Pond: Nine species. Located just south of Hwy. 66 on the road to Long Point. The pond is on the west side of the road and hidden by a steep bank covered with impenetrable (see Jerrell's earlier comment) thorn scrub. The pond itself is clogged with 10-foot high cattails although there is a narrow shore band of lower aquatic vegetation with some open water. N 17° 41.480', W 64° 50.620', elevation 30 ft.

Fred engaged in "Fredding" for dragonflies. Photo by Jerrell J. Daigle.

Acknowledgements

I wish to thank Diane L. Freas-Lutz and Olasee Davis of the University of the Virgin Islands for their previous help in greasing the skids and in locating freshwater habitats. We met Lisa Ynterma, island resident and birder, at one pond and she has been invaluable in supplying information about water sites on the island. Olasee Davis was leading a group of students on an ecology trip in the Caledonia Valley when we met him on this trips. He told his group we were the world famous dragonfly guys. True, but thanks, Olasee, for the endorsement!

Seaside Dragonlet (*Erythridiplax berenice*) Population on Bitter Lake National Wildlife Refuge in New Mexico

Robert Larsen and Bill Flynt, II < flynt@plateautel.net>

The inland populations of Seaside Dragonlet (*Erythrodiplax berenice*), a true marine species, are found in relict saline sinkhole habitats from the Permian Period in the central Pecos Valley of New Mexico and Texas. These relict sinks are from a time when an ancient shallow sea covered the region and formed the Capitan Reef of west Texas and southern New Mexico. The inland populations of Seaside Dragonlet on the Bitter Lake National Wildlife Refuge are most abundant at Sink #19, Lake St. Francis (a sinkhole), small sinks at Dragonfly Springs, and at the Inkpot sinkhole in the Salt Creek Wilderness. Seaside Dragonlets commonly utilize the refuge's wetland impoundments as well. Three of the locations on the refuge (Sink #19, Lake St. Francis and Dragonfly Springs) are not open to the public, but the Inkpot on the refuge's Salt Creek Wilderness as well as Mirror Lake at Bottomless Lakes State Park, located a few miles south of the refuge, are open to visitors.

Seaside Dragonlet (*Erythrodiplax berenice*), Form 1 male. Photo by Bill Flynt, II.

It is believed that once the Permian Sea receded, an older Seaside Dragonlet population was geographically isolated from the coastal populations. Geographic isolation is thought to be one of the factors in the creation of new species. Because we have various forms here but not new species, they may still be in the process of speciation, giving rise to the different forms of Seaside Dragonlet we find today in the central Pecos Valley. It is not known how long geologically this species has been here, however.

Generally, this marine dragonlet is a species of the southern and eastern coastal salt marsh habitats south into the coastal waters of the Greater Antilles (Cuba, Jamaica, Puerto Rico and the Bahamas). Interestingly, all that is known about these somewhat distinct inland populations of the dragonlet is that there are some six distinct female forms and two distinct male forms in these inland habitats. In general, mature males are small (1.3 in.), all black, with no basal wing spots and a slender abdomen. Females vary in appearance (sometimes resembling males), although they all exhibit a pointed spout-like ovipositor as long as their eighth abdominal segment. The spotted female form seldom develops an all-black body and exhibits a large nodal spot. This form is commonly observed throughout the refuge.

The two male forms of the Seaside Dragonlet are:
1. Jet black, sometimes with a dusky pruinosity over the thorax and abdomen, with clear wings.
2. Jet black with pruinosity at times, with black or brownish spots at the base of the hindwing.

Seaside Dragonlet (*Erythrodiplax berenice*), "All Black" Form 2 female. Photo by Bill Flynt, II.

There are basically six female forms. The atypical female forms are:
1. "All Black", an andromorphic jet black female with black thorax and abdomen, and clear wings.
2. "All Black", jet black thorax and abdomen, with a blackish brown spot at the base of the hind wing, and a dusky pruinosity with age.
3. "All Black", an andromorphic female with a somewhat large amber flavescent patch at the base of the hindwing.

The more typical female forms are:
4. "Desert Lake", yellow thorax marked with black stripes, abdomen marked in orange dorsally and black below, wings with a flavescent yellow marking at the base and a large brown patch over the nodus. The black abdominal markings become larger with age and show a dusky pruinosity over the abdomen.
5. "Spotted Wing", the most typical female form, with black-striped yellow thorax, abdomen marked in orange and black, wings showing a large brown patch over the nodus, and flavescent patch at the base of the wings.
6. "Black", black thorax, abdomen marked in orange, and black and clear wings.

The coastal distribution of the Seaside Dragonlet is along the Gulf and Atlantic Coasts north to Nova Scotia and, surprisingly, these pristine relict sinks in the central Pecos Valley. Although they are also found on the refuge in the impoundments and oxbows containing primitive stonewart (*Nitella* and *Chara*), these habitats were human-made after channeling the Pecos River in the 1930s. However, all of the reproductive sites for all forms of the Seaside Dragonlet contain this very ancient stonewort, an aquatic plant that is apparently a habitat requirement for the inland populations.

These populations of *Erythrodiplax berenice* are limited to the saline sinkholes containing Stonewort and a relic intertidal marine green algae (*Bataphora oerstedii*) known only from the coastal waters and lagoons from Bermuda to the Gulf Coast, and these inland sinks in the Central Pecos Valley. The Seaside Dragonlet is found in relict sinkholes from Guadalupe County, New Mexico in the north to Pecos County, Texas in the south. On the Bitter Lake Refuge, the relict sinks also contain three species of mollusks and an amphipod only known from these local spring and sink habitats. The salinity of these relict habitats ranges from 1.5 to 3.5%, and several other salt-tolerant odonate species such as Marl Pennant (*Macrodiplax balteata*) and Sulphur-tipped Clubtail (*Gomphus militaris*) are found here, along with the Plateau Dragonlet (*Erythrodiplax basifusca*), the intermediate form of the Western Pondhawk (*Erythemis collocata*), and several species of setwing (*Dythemis*) dragonflies.

Seaside Dragonlet is the only dragonfly species in the western hemisphere that can breed in undiluted seawater. Accord-

Seaside Dragonlet (*Erythrodiplax berenice*), tandem pair with "Spotted Wing" female. Photo by Bill Flynt, II.

Seaside Dragonlet (*Erythrodiplax berenice*), mature "Black" female. Photo by Bill Flynt, II.

Seaside Dragonlet (*Erythrodiplax berenice*), "Desert Lake" female. Photo by Bill Flynt, II.

ing to Corbet 2004 (Dragonflies: Behaviour and Ecology of Odonata), the coastal habitats of the Seaside Dragonlet are fishless, but inland larval habitats show numerous fish including the last pure strains of the Pecos Pupfish (*Cyprinodon pecosensis*), the endangered Pecos Gambusia (*Gambusia nobilis*), and the Plains Killifish (*Fundulus zebrinus*).

Adult Seaside Dragonlets are most active from mid-May through mid-September. Pairs lay eggs in tandem, usually into algae mats or submerged *Nitella* and/or *Chara* stoneworts. Eggs are round or oval, green in color, and usually covered with a sticky jelly. These eggs hatch into brown or green aquatic larvae which grow by molting their skin (exuviae). Larval feeding is primarily on small amphipods, ostracods, and water mites, as observed among nymphs collected from Lake St. Francis on the Bitter Lake Refuge. The dragonlet nymph may also feed on small fish such as *Gambusia* spp. Final instar (F-0) larvae climb out of the water and onto a support, where they swallow air to help inflate their bodies and split the larval skin so the adult emerges. Emergence usually takes place at night, and around the time that inland Sea Lavender (*Limonium limbatum*) begins to bloom throughout the refuge.

Seaside Dragonlet adults have been observed feeding primarily on butterflies, especially Western Pygmy Blue (*Brephidium exilis*) and Marine Blue (*Leptotes marina*). Feeding on butterflies was also noted in 1930 by Byers in his study of the Seaside Dragonlet in coastal Florida populations. These butterflies are attracted in large numbers to the flowers of inland sea lavender that grow about the sinks.

Predators of the Seaside Dragonlet include small mammals, fish, birds, and other invertebrates. Stressors include loss of suitable habitat, increased pollution, and decreaed water quality. One major threat to this species is the depletion of ground water due to pumping and human modification of critical sink habitats.

OdeLog—Coming Soon to a Mobile Device Near You!

The following is re-printed with permission of developer David Bell from an announcement by BirdsEye Apps:

We're excited to announce that our partnership with OdonataCentral continues with OdeLog—the OdonataCentral Mobile App. OdeLog will allow you to record checklists of odes you observe in the field from your smartphone.

Many people keep records of the odes they observe but only a tiny fraction of these potentially important observations make their way into public databases. The goal of OdonataCentral is to capture this valuable information and make it available to the public forever and for free. OdeLog is designed to make collecting and managing ode sightings easier and more fun. Currently our plan is to make OdeLog a free app if we can raise enough donations to make this goal feasible. Our goal is to release it before the peak of the summer ode season.

As early supporters of eBird, we believe that it is an excellent model of how to set up a citizen science project. Not only is eBird fun and easy to use, perhaps most importantly, the data are useful to scientists for large-scale population monitoring of population, seasonality and distribution. To accomplish our goal of building the "eBird for Odes", we will follow these guiding principles:

1. All the observations will go into OdonataCentral/ Migratory Dragonfly Partnership. We don't believe it makes sense to create another separate citizen science database. Instead we would prefer to see our efforts go towards improving an already excellent database. Note that OdonataCentral and the Migratory Dragonfly Partnership share an underlying database.

2. Our goal is to maintain three types of data: A) the OdonataCentral records that have passed their careful vetting process. These will mostly consist of rare sightings or difficult to identify species; B) publicly shared data that can be accessed by all users that go through a less rigorous automatic vetting process (under development) and consists of more common species; C) your personal records will be maintained in the database regardless of their vetting status so you can access your own data and maintain your own lists. You will be able to filter the data to only see the data type you want.

3. Users will be encouraged to enter complete checklists of the odes observed in a specified time and location, including counts. Our goal is to not only capture sightings of rare species but to also encourage sightings of common species. This information is the most valuable in understanding the long term trends for the health of ode populations and their habitats.

4. Checklists should be associated with an observation protocol. The observation protocol indicates the type and level of effort that went into recording the sightings. Protocol encompasses things like distance traveled, time spent, area surveyed, etc.

5.Users should be encouraged and enabled to identify dragonflies to the best of their ability, but not beyond. We will provide the option to report things like "Northern/Boreal Bluet", "Bluet sp.", *Libellula* sp. or even just "Dragonfly sp." If users aren't sure, we don't want to force them to guess. Users should be encouraged and able to report odes in all of their life stages.

You can help make this happen! This project is not expected to earn money. Everyone involved in this project is doing it out of a sense of just how valuable (and awesomely fun!) it would be to have this tool available for ourselves and other nature lovers. If you are interested in helping as a tester, as a user, as a contributor of text or photos, or financially please make your contribution online at <http://www.birdseyebirding.com/2016/04/14/announcing-odonatacentral-mobile-see-mobile-sightings-entry-dragonflies/> or e-mail us at <support@getbirdseye.com>.

Our goal is to make this simple first step available this summer, and we hope it will be before the peak of the dragonfly and damselfly season in most of the U.S. and Canada. Here is a very rough outline:

It will connect with the OdonataCentral/Migratory Dragonfly Partnership database. Submissions will be tied to OdonataCentral user accounts. New users will need to set up OC accounts to submit sightings. Currently we don't have funding for several critical features including the interface to submit photos from the app. We plan to roll out iOS first and then Android.

Clearly the data will be of a different type than the 100% vouchered data currently in OdonataCentral and in that sense will be more like Migratory Dragonfly Partnership data. We do not want to (pick your favorite pejorative) "dilute" that data with unvetted submissions. On the other hand, we do believe that this new data will be valuable and should be available through the OC website. So we will find ways to allow users to view just traditional OC data, this new OC data or both together.

Initially it will only be possible to submit data through the OdeLog app, but we plan to build out the portions of the OC website that will allow OC users to submit observations online as well. For more information and to find out how you can contribute to the project, visit <http://tinyurl.com/gl29nhb>.

Dragonfly Day Coming to North Pole, Alaska, on 25 June 2016

John Husdon <odonatak@gmail.com>

The U.S. Fish and Wildlife Service and Friends of Alaska National Wildlife Refuges will be sponsoring a dragonfly day in North Pole, Alaska this June. Dragonfly Day 2016 will be held at Chena Lake Recreation Area on Saturday, 25 June. The event is free and open to the public and will be held at the Swim Beach Pavilion from 11 am to 4 pm.

Dragonfly Day is a public event designed to introduce children and adults to the identification and ecology of dragonflies. As larvae and adults, dragonflies play important roles as both predator and prey in aquatic and terrestrial systems, making them ideal subjects for introducing the concept of ecological relationships. Their dependence on wetlands and their dualistic position in the food chain make them good indicators of ecosystem health.

Previous Dragonfly Day activities have included dragonfly-themed cookie decorating, arts and crafts, face painting, and balloon animal making. Live dragonfly larvae and other aquatic invertebrates will be on display in "touch tank" aquaria. Past event partners include the National Park Service, U.S. Army Corps of Engineers, University of Alaska Fairbanks, and a variety of local vendors and small businesses. In 2014, there were over 500 attendees. Dragonfly Day was cancelled in 2015 due to smoky and unhealthy air conditions due to nearby wildfires.


A cookie decorator shows off her edible artwork at the 2014 Dragonfly Day in North Pole, Alaska. Photo by USFWS.

The highlight of the event is when Alaska dragonfly expert John Hudson, co-author of the field guide "Dragonflies of Alaska", leads families on nature walks and demonstrates how to properly collect and identify dragonflies. Hudson shows participants how to use equipment such as aerial nets, field guides, and hand lenses. During the nature walks, he encourages kids and adults

alike to become comfortable handling insects as a way of "connecting people with nature," an initiative by the Service to inspire kids and adults to get outdoors and develop a better understanding of the natural world.

Two sisters peer into their dragonfly net on the shores of Chena Lake during the 2014 Dragonfly Day. Photo by USFWS.

Jumping Spiders Living in Dragonfly Exuviae

My paper on use of dragonfly exuviae by jumping spiders (Salticidae), particularly *Sassacus vitis*, has at last been published, in Peckhamia, the journal of the Peckham Society, and can be viewed on-line at <http://peckhamia.com/peckhamia/PECKHAMIA_142.1.pdf>.

My thanks to DSA members who responded to my earlier appeals in previous issues of Argia for information about observations of this behavior. I remain interested in documenting this behavior and encourage all odonatologists who collect exuviae to watch for it and report their observations.

Tim Manolis <ylightfoot@aol.com>

Odonata in the News

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

Campos F., T. Velasco, G. Sanz, P. Casanueva, M.T.D. Albuquerque, and I.M.H.R. Antunes. 2016. *Ischnura graellsii* (Insecta: Odonata), a water pollution biovulnerability indicator—probability mapping using spatial uncertainty. River Research and Applications 32(3): 483–489. Monitoring changes of anthropogenic impacts from a broad scope of species in biodiversity research requires practical, easy-to-use and efficient assessment as well as monitoring methods. Odonates (Insecta: Odonata) are a valuable tool for assessing freshwater systems' quality and have been used as bioindicators of environmental variety. The Águeda watershed, located in the central west of the Iberian Peninsula, shows an exponential increase in the last 60 years of natural resource exploitation coupled with alterations in consumer habits, causing significant environmental changes and deferred direct effects on the natural habitats. Fourteen river sites, selected *a priori*, were sampled. Adult odonates were collected using standardized methods. Selected environmental variables and water quality parameters were evaluated *in situ*. Precipitation and altitude were the most important physical, environmental variables in explaining the assemblage structure. Meaningful abiotic–biotic as well as biotic–biotic relationships were set up. Furthermore, situations in the urbanized watershed area showed to be highly impacted and closely related with damselfly *Ischnura graellsii*, which should be targeted as a possible vulnerability indicator for polluted fresh waters. A probability map for *I. graellsii* distribution was performed using indicator kriging with external drift and spatial uncertainty obtain through the calculation of two categorical maps (binary), corresponding to the mean (0.485) and the trimmed mean by discharging the 10% lower distribution tail (0.533). The subsequent overlapping of both categorical maps allowed definition of the higher

spatial uncertainty map for surface water contamination.

Ilvonen J.J., K.M. Kaunisto, and Jukka Suhonen. 2015. Are sexes equally parasitized in damselflies and dragonflies? Oikos 125(3): 315–325. Parasitism plays an essential part in ecology and evolution of host species and understanding the reasons for differential parasitism within and among hosts species is therefore important. Among the very important factors potentially affecting parasitism is the gender of the host. Here, we studied whether either females or males are more likely to harbour parasites among odonates, by relying on an extensive literature review and new field data. We collected data on numerous dragonfly and damselfly species and their ectoparasites (water mites) and endoparasites (gregarines) to examine the generality of similarities and differences in prevalence, intensity, and maximum number of parasites of male and female hosts. We found three main results. First, most of the odonate host species showed no differences between sexes in either gregarine or water mite prevalence and intensity. The only exception was female damselflies' higher gregarine prevalence and intensity compared to conspecific males. These inequalities in gregarine parasitism may be due to behavioral and physiological differences between conspecific males and females. In comparison, there were no differences in dragonflies between sexes in water mite or gregarine prevalence and intensity. Second, damselflies had higher prevalence and intensity levels of both gregarine and water mite parasites compared to dragonflies. Finally, we found a strong species level pattern between female and male parasitism: a certain level of gregarine or water mite parasitism in one sex was matched with a similar parasitism level for the other. This indicates similar exposure and susceptibility to parasites on both sexes. Even though significant differences of parasite levels between the sexes were observed within certain host species, our results strongly suggest that on a general level a more parasitized sex does not exist in the order Odonata.

Tichanek, F. and R. Tropek. Conservation value of post-mining headwaters: drainage channels at a lignite spoil heap harbour threatened stream dragonflies. Journal of Insect Conservation 19(5): 975-985. Headwaters and small streams are crucial components of riverine systems, harbouring many highly specialized and unique invertebrate species. Unfortunately, the overwhelming majority of the Central European lowland headwaters are channelized, eutrophicated, and/or polluted, and many related species have become critically endangered. Artificial streams established to drain some post-mining sites supplement a network of headwaters and generally do not suffer from agricultural pollution. Nevertheless, the biodiversity and conservation potential of the streams at post-mining sites has never been evaluated. We studied the biodiversity of dragonflies and damselflies (Odonata) at 53 sections (30 m) of an extraordinarily dense system of drainage ditches at a large lignite spoil heap in the Czech Republic. We recorded 22 dragonfly species, of which eight are threatened according to the national Red List. Moreover, four of them are closely associated with the endangered environment of small streams. Overall diversity was generally low at very tiny and/or narrowed streams and was also strongly reduced by high water velocity, high bankside inclination and dominance of expansive common reeds. Sufficient cover of rather shallow sediment layers strongly supports the studied diversity indicators. We thus conclude that post-mining streams in drainage ditches could have a strong potential to offer secondary habitats for threatened headwater biodiversity. However, intermittent reed suppression and the establishment of gently sloping banks and a structured stream bottom are necessary measures for maximizing post-mining stream conservation.

Bried J.T., N.E. McIntyre, A.R. Dzialowski, and C.A. Davis. 2015. Resident-immigrant dichotomy matters for classifying wetland site groups and metacommunities. Freshwater Biology 60(11): 2248–2260. The fact that species have resident (autochthonous) or immigrant (allochthonous) status at any given locality may have strong implications for ecological analysis. We used wetlands and adult odonates as a model system to evaluate the resident-immigrant dichotomy for two modes of community analysis: (1) grouping sites based on species compositional variation and (2) identifying metacommunity structure. We tested a hypothesis of gradient-structured (non-random) resident occurrence versus unstructured (random) immigrant occurrence in the metacommunity context and predicted the resident occurrence would more effectively partition community variation and produce stronger site groupings than total (resident + immigrant) occurrence. Site group classification after fractioning out resident occurrence consistently and in some cases dramatically outperformed total occurrence. Resident damselflies produced the strongest classifications, which we attribute to greater dispersal limitation, environmental sorting or both. As predicted only the resident occurrence led to identifiable metacommunity structures, primarily Clementsian-style turnover. This suggests the resident occurrence is gradient-driven with species responding similarly to abiotic filters, whereas immigrant occurrence is more opportunistic and random. The resident-immigrant dichotomy appears to have strong influence on quantitative classification of sites and metacommunities, and species composition of resident adult damselflies is potentially useful for differentiating and indicating site groups of non-forested freshwater wetlands.

Berquier C., A. Orsini, L. Ferrat, and M.-C. Andrei-Ruiz. 2016. "Odonata Community Index—Corsica" (OCIC): A new biological index based on adult odonate populations for assessment of the ecological status of watercourses in Corsica. Ecological Indicators 66: 163–172. Corsica is a French island in the western Mediterranean with numerous distinct geomorphological, landscape, and biological characteristics. These specific attributes, mostly related to insularity, are hardly taken into account by the biological indices currently recommended in the framework of the European Union Water Framework Directive "WFD" for assessing the ecological status of watercourses. Thus, this work has focused on developing an innovative biological index adapted to the specific context of territories such as Corsica, based on the Odonata group. In this context, imago sampling of Odonata was performed at 40 representative stations to assess the 33 major permanent rivers of the island. In parallel, various biological, hydrological, and physicochemical parameters affecting the ecological status of these organisms were recorded. The data collected on nearly 30 species of Odonata allowed for the accurate description of the typical populations of Corsican watercourses, highlighting this group's potential as a biological indicator. An indicator value was assigned to the 12 species identified as the most representative of these environments. The results were used to develop biological indices based on simple statistical descriptors. The index found to be the best for assessing the ecological status of the watercourses, as indicated by correlation tests, was named "Odonata Community Index—Corsica" (OCIC), and was finally confronted with the five biological indices recommended by the WFD and currently used in Corsica. The results of this study confirm significant potential of the OCIC index compared to other "official" indicators, that are limited as they do not accurately assess all territories. Our results indicate that this new Odonata index appears to be a credible method that could potentially improve the evaluation system currently used for monitoring the ecological quality of watercourses in Corsica.

Zhao Q., Y. Pan, J.N. Griffin, J. Sun, and S. Sun. 2016. Contrasting trophic-cascade effects driven by variation in morphology of the perches used by a larval damselfly. Freshwater Biology 61(5): 693–701. The presence of habitat structures (e.g. caves, ledges, branches) has well-documented ecological effects. However, it remains largely unknown how variation in the morphology of particular habitat structures affects ecological interactions. Using an algae–cladoceran grazer–larval damselfly food chain as a model in a series of microcosm experiments, we manipulated food-chain length and the length (long vs. short) and diameter (thick vs. thin) of vertically-oriented damselfly perches (habitat structure) and examined the density of grazers and algae. Because the larval damselflies are usually more flexible on thinner perches and have broader foraging domains on longer perches, we predicted that when on long and thin perches they would suppress grazer density more efficiently and hence confer a more positive trophic-cascade effect on algal growth. As predicted, larval damselflies occupying long and thin perches most strongly reduced grazer density and increased algal density, illustrating a positive trophic cascade. In all other damselfly treatments, and despite reduced grazer density, algal density declined, showing a negative trophic cascade due to an elevation in grazer foraging efficiency under predation risk. This probably resulted from the increased activity of the grazers and their spatial shift to the lower water column where algal density was higher. In conclusion, perch morphology affected the direction and strength of the trophic cascade by altering both density-mediated and behaviour-mediated indirect interactions. Considering that anthropogenic disturbance is dramatically changing the morphological diversity of habitat structures, we call for more research into the ecological consequences of such physical diversity at community and ecosystem levels.

Kosterin O.E. and N. Yokoi. 2016. *Asiagomphus reinhardti sp. nov.* (Odonata, Gomphidae) from eastern Cambodia and southern Laos. Zootaxa 4103(1): 35–42. *Asiagomphus reinhardti sp. nov.* is described by two males from Annamense Mountains in eastern Cambodia and southern Laos. The species is characterised by a large caudal lobe on S10 in males and a blunt medial lateroventral projection at the cercus.

Sniegula S., M.J. Golab, and F. Johansson. 2016. A large-scale latitudinal pattern of life-history traits in a strictly univoltine damselfly. Ecological Entomology DOI: 10.1111/een.12314. Variation in thermal conditions and season length along latitudinal gradients affect body size-related traits over different life stages. Selection is expected to optimise these size traits in response to the costs and benefits. Egg, hatchling, larval, and adult size in males and females were estimated along a latitudinal gradient of 2,730 km across Europe in the univoltine damselfly *Lestes sponsa*, using a combination of field-collection and laboratory-rearing experiments. In the laboratory, individuals were grown in temperatures and photoperiod simulating those at the latitude of origin, and in common-garden conditions. The size of adults sampled in nature was negatively correlated with latitude. In all populations the females were larger than the males. Results from simulated and common-garden rearing experiments supported this pattern of size difference across latitudes and between sexes, suggesting a genetic component for the latitudinal size trend and female-biased size dimorphism. In contrast, hatchling size showed a positive relationship with latitude, but egg size, although differing between

latitudes, showed no such relationship. The results support a converse Bergmann cline, i.e. a negative body size cline towards the north. This negative cline in body size is probably driven by progressively stronger seasonal time and temperature constraints towards the higher latitudes and by the obligate univoltine life cycle of *L. sponsa*. As egg size showed no relationship with latitude, other environmental factors besides temperature, such as desiccation risk, probably affect this trait.

Debecker S., I. Sanmartín-Villar, M. de Guinea-Luengo, A. Cordero-Rivera, and R. Stoks. 2016. Integrating the pace-of-life syndrome across species, sexes and individuals: covariation of life history and personality under pesticide exposure. Journal of Animal Ecology 85(3): 726–738. The pace-of-life syndrome (POLS) hypothesis integrates covariation of life-history traits along a fast–slow continuum and covariation of behavioural traits along a proactive–reactive personality continuum. Few studies have investigated these predicted life-history/personality associations among species and between sexes. Furthermore, whether and how contaminants interfere with POLS patterns remains unexplored. We tested for covariation patterns in life history and in behaviour, and for life-history/personality covariation among species, among individuals within species and between sexes. Moreover, we investigated whether pesticide exposure affects covariation between life history and behaviour and whether species and sexes with a faster POLS strategy have a higher sensitivity to pesticides. We reared larvae of four species of *Ischnura* damselflies in a common garden experiment with an insecticide treatment (chlorpyrifos absent/present) in the final instar. We measured four life-history traits (larval growth rate during pesticide treatment, larval development time, adult mass, life span) and two behavioural traits (larval feeding activity and boldness, each before and after the pesticide treatment). At the individual level, life-history traits and behavioural traits aligned along a fast–slow and a proactive–reactive continuum. Species-specific differences in life history, with fast-lived species having faster larval growth and development, lower mass at emergence and shorter life span, suggested that time constraints in the larval stage were driving life-history evolution both in the larval stage and across metamorphosis in the adult stage. Across species, females were consistently more slow-lived than males, reflecting that a large body size and a long life span are generally more important for females. In contrast to the POLS hypothesis, there was only little evidence for expected positive coupling between life-history pace and proactivity. Pesticide exposure decreased larval growth rate and affected life-history/personality covariation in the most fast-lived species. Our study supports the existence of life-history and behavioural continua with limited support for life-history/personality covariation. Variation in digestive physiology may explain this decoupling of life history and behaviour and provide valuable mechanistic insights to understand and predict the occurrence of life-history/personality covariation patterns.

Baird I.R.C. and S. Burgin. 2016. Conservation of a groundwater-dependent mire-dwelling dragonfly: implications of multiple threatening processes. Journal of Insect Conservation 20(2): 165–178. Groundwater-dependent ecosystems and their dependent species are under increasing threat globally. Petalurid dragonflies are one such group. This review highlights processes that threaten the groundwater-dependent mire habitats of *Petalura gigantea*, a dragonfly with long-lived fossorial larvae. The species relies on areas of emergent seepage, or at least, on a water table that is sufficiently high to saturate the peaty substrate. These microhabitat characteristics are critical for successful oviposition and larval burrow establishment, making the species particularly vulnerable to any lowering of water tables. The effect of any lowering of water tables, due to groundwater abstraction or long-wall coal mining, for example, will be compounded by the effects of more intense fire regimes in these mires and by projected climate change. These threatening processes act in conjunction with a range of other anthropogenic threats and are mirrored globally in threats to other groundwater-dependent mire ecosystems and their dependent species, including other petalurid dragonflies.

Cordero-Rivera, A. 2016. Demographics and adult activity of *Hemiphlebia mirabilis*: a short-lived species with a huge population size (Odonata: Hemiphlebiidae). Insect Conservation and Diversity 9: 108–117. Rare species are expected to be more susceptible to extinction, particularly if rarity can be used to describe several characteristics for a particular species. *Hemiphlebia mirabilis*, an endemic damselfly known from a few sites in the South of Australia and Tasmania, has been considered at risk of imminent global extinction, given its small population size, localised distribution, and the fact that it is a 'living fossil', described as the oldest extant damselfly. A population in a protected wetland in Victoria was studied by behavioural observations of marked animals during Nov–Dec 2013. Results indicate that *H. mirabilis* is a short-lived species, with a mature lifespan of one week in males and four days in females. Population size estimates and field observations indicate that this population is huge, likely over one million individuals/generation. Adults show little mobility and fly short distances, being inactive most of the time, particularly at temperatures below 17°C or over 35°C. The low mobility and cryptic coloration, and the inaccessibility of its preferred habitat might explain why huge populations like the one studied here have remained unnoticed

until recently. Nevertheless, both sexes show frequent abdominal flicking displays, and fast rotations over the perching support, both behaviours apparently unique to this species, making them highly conspicuous to human observers. It is concluded that *H. mirabilis* should not be regarded as critically endangered.

Andersen E., B. Nilsson, and G. Sahlén. 2016. Survival possibilities of the dragonfly *Aeshna viridis* (Insecta, Odonata) in southern Sweden predicted from dispersal possibilities. Journal of Insect Conservation 20(2): 179–188. We use public records from 1980–2014 to analyse survival of the EU Annex IV species *Aeshna viridis* in Sweden, a dragonfly strongly associated with the plant *Stratiotes aloides*. We clustered localities with *S. aloides* based on assumed dispersal abilities of *A. viridis*, using a dispersing radius of 2–100 km, calculating the proportion of sites with *S. aloides* that *A. viridis* is able to reach. If mean dispersal capability is high (≥40 km), 92.6% or more of the localities are connected. For a good disperser, the probability of long-time survival is good. We further analysed the species richness of other Odonata and aquatic plants at 98 localities from the dataset. *A. viridis* co-occurred with more Odonata in the presence of *S. aloides* and running water but not in lakes. *S. aloides* sites had a higher number of other aquatic plants. Area had no impact on the occurrence of the species. We surveyed 32 localities with known occurrence of the species. Only half of the sites for *S. aloides* contained any specimens while *A. viridis* occurred in the same number of sites. The species co-occurred in only eight of 32 sites. In four sites *A. viridis* larvae appeared among *Menyanthes trifoliata*, *Phragmites australis*, *Potamogeton natans* and *Sphagnum* spp., indicating that at high latitudes *A. viridis* breeds among other species. Indirect monitoring based only on *S. aloides* would underestimate the number of populations of the dragonfly.

Torres-Cambas Y., M. Cabana-Otero, M.O. Lorenzo-Carballa and A. Cordero-Rivera. 2016. Conservation status and protection of three Antillean endemic damselflies. Journal of Insect Conservation 20(2): 277–284. *Hypolestes* (Odonata, Zygoptera) is a damselfly genus endemic to the Greater Antilles. The genus comprises three species: *H. clara* from Jamaica, *H. trinitatis* from Cuba, and *H. hatuey* from Hispaniola, which are currently evaluated by the IUCN as Endangered (EN), Vulnerable (VU) and Data Deficient, respectively. Here, we re-assess the conservation status of these species based on their extent of occurrence, as estimated from ecological niche models. In addition, we analyse the coverage offered to each of the three species by the protected areas from Jamaica, Cuba, Dominican Republic and Haiti. Our results support the maintenance *H. trinitatis* in the category of VU, and suggest the re-classification of *H. hatuey* as Near Threatened. The estimated extent of occurrence for *H. clara* is 6422 km^2, a value close to the threshold of 5000 km^2 between VU and EN. Therefore, we recommend keeping *H. clara* as EN, until new evidence based on population size and trend could support a change from this category to VU. We found that 14% of the extent of occurrence for *H. clara* and *H. hatuey*, and 33% for *H. trinitatis*, are within protected areas. However, the ongoing extensive deforestation in Hispaniola, coupled with the lack of protection in Haiti, could cause a decrease of the extent of occurrence of *H. hatuey* in the future.

Low V.L., M. Sofian-Azirun and Y. Norma-Rashid. 2016. Playing hide-and-seek with the tiny dragonfly: DNA barcoding discriminates multiple lineages of *Nannophya pygmaea* in Asia. Journal of Insect Conservation 20(2): 339–343. We examined the utility of DNA barcode data for assessing genetic diversity of the tiny dragonfly *Nannophya pygmaea* Rambur in Asia. Data analyses inferred from the barcode region of cytochrome oxidase subunit I (COI) were performed with Malaysian *N. pygmaea*, along with the existing COI haplotypes distributed in Asia. We applied four species delimitation analyses [automatic barcode gap discovery, generalised mixed yule coalescent, poisson tree processes maximum likelihood and poisson tree processes simple heuristic solutions] to investigate potential lineages in this widespread species. Based on our dataset, we provisionally recognize four distinct lineages or operational taxonomic units of *N. pygmaea*, which were represented by the taxa from Japan/Korea, China/Laos/Taiwan, Malaysia and Vietnam, respectively. Phylogenetic analyses showed two well-supported assemblages of *N. pygmaea*: one restricted to the taxa from Malaysia and Vietnam; and the other covering all populations further north (i.e., China, Japan, Korea, Laos and Taiwan). An extraordinarily high degree of genetic distance (up to 12%) was detected between these two assemblages, suggesting they represent two separate species.

Eagles-Smith C.A., S.J. Nelson, J.J. Willacker, Jr., C.M. Flanagan Pritz, and D.P. Krabbenhoft. 2016. Dragonfly Mercury Project—A citizen science driven approach to linking surface-water chemistry and landscape characteristics to biosentinels on a national scale. U.S. Geological Survey Fact Sheet 2016-3005, 4 pp. <http://pubs.usgs.gov/fs/2016/3005/fs20163005.pdf>. Mercury is a globally distributed pollutant that threatens human and ecosystem health. Even protected areas, such as national parks, are subjected to mercury contamination because it is delivered through atmospheric deposition, often after long-range transport. In aquatic ecosystems, certain environmental conditions can promote microbial processes that convert inorganic mercury to an organic form (methylmercury). Methylmercury biomagnifies through food

webs and is a potent neurotoxicant and endocrine disruptor. The U.S. Geological Survey, University of Maine, and National Park Service Air Resources Division are working in partnership at more than 50 national parks across the U.S., with citizen scientists as key participants in data collection, to develop dragonfly nymphs as biosentinels for mercury in aquatic food webs. To validate use of these biosentinels and gain a better understanding of the connection between biotic and abiotic pools of mercury, this project also includes collection of landscape data and surface-water chemistry including mercury, methylmercury, pH, sulfate, and dissolved organic carbon and sediment mercury concentration. Because of the wide geographic scope of the research, the project also provides a nationwide "snapshot" of mercury in primarily undeveloped watersheds.

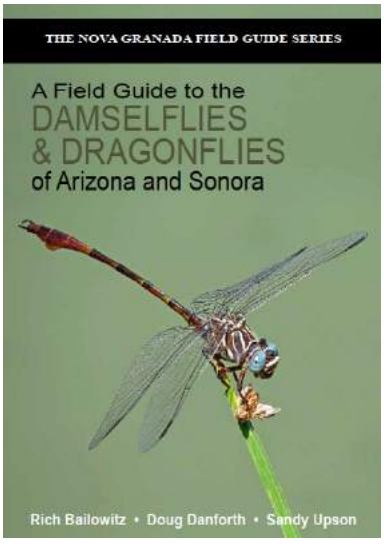
Myrup, A.R. and R.W. Baumann. 2016. The dragonflies and damselflies (Odonata) of Utah. Monographs of the Western North American Naturalist 9(1): 1–114. An updated faunal list containing 94 species of Odonata (60 Anisoptera and 34 Zygoptera) for Utah is presented. Of the 95 Odonata species recorded in past publications as being from Utah, eight have been removed from the Utah Odonata list, while seven new state records have been added. Explanations for their removal are provided in the species accounts. The seven ecoregions found in Utah are briefly described along with their wetland habitats and odonate species. Geographical distribution data by county, drainage, and ecoregion are provided for each species along with information regarding elevation range, flight season, and habitat preferences in Utah. Specific comments relevant to the distribution and abundance of each species are provided. Distribution maps illustrate collection locations against a background of county boundaries and topography. State conservation rankings using methods described by NatureServe are recommended.

Mens L.P., K. Schütte, F.R. Stokvis, and K.-D.B. Dijkstra. 2016. Six, not two, species of *Acisoma* pintail dragonfly (Odonata: Libellulidae). Zootaxa 4109(2): 153. The dragonfly genus *Acisoma* is revised based on adult male morphology and COI sequence data. Six species are recognised, including the new species *A. attenboroughi sp. nov.* Diagnoses and a key to males of all species and illustrations of all relevant characters are provided. *A. inflatum*, *A. variegatum* and *A. trifidum* are confined to continental Africa, while *A. panorpoides* is restricted to Asia. *A. ascalaphoides* is known only from threatened littoral forest fragments on the east coast of Madagascar, while *A. attenboroughi* is widespread across the island. The new species honours Sir David Attenborough on his 90th birthday.

Dr. Georg Rüppell of Cremlingen, Germany has been making slow-motion films of odonates for 30 years. Many of these films are now available on YouTube, in the hope that people will use them to learn more about dragonfly behavior. Visit his YouTube site at <https://www.youtube.com/user/kirsche204> to see some amazing footage in videos such as Fascinating Helicopter Damselflies, Female Choice in a Dragonfly, Demoiselles Talking With Their Wings, Dragonfly Drama in Texas, and more!

New Book: A Field Guide to the Damselflies and Dragonflies of Arizona and Sonora, by Rich Bailowitz, Doug Danforth, and Sandy Upson

A Field Guide to the Damselflies and Dragonflies of Arizona and Sonora, by Rich Bailowitz, Doug Danforth, and Sandy Upson. ISBN: 978-0-9909023-0-0. Soft cover, 459 pp., 621 photos, 93 line drawings, 118 scans, and 5 full-page maps. $38.95 ($34.95 book, $4 shipping & handling). To purchase, contact Rich Bailowitz at <raberg2@Q.com>.



The publishing arm of Drylands Institute, Nova Granada Books, is proud to announce the publication of its new book, "A Field Guide to the Damselflies and Dragonflies of Arizona and Sonora", by Rich Bailowitz, Doug Danforth, and Sandy Upson. This book is a complete field guide to the odonate species of the two adjacent states of Arizona (U.S.) and Sonora (Mexico), and is the first guide to take a comprehensive look at a Mexican state. It covers 167 species, including 16 species not known in the U.S.

Book Review: A Guide to the Dragonflies & Damselflies of South Africa, by Warwick and Michèle Tarboton

Dennis Paulson <dennispaulson@comcast.net>

A Guide to the Dragonflies & Damselflies of South Africa, by Warwick & Michèle Tarboton. ISBN: 9781775841845. Struik Nature, Cape Town, South Africa. 2015. Soft cover, 224 pp. Available as print or e-book. R259.00 South African Rand ($18.21 USD on Apr 30, 2016). Order from <www.netbooks.co.za>

This is another bargain in the line of regional Odonata books, but easily worth twice the price. It is a brand-new offering from the Tarbotons of South Africa, a merging of their now out-of-print separate books on dragonflies (2002) and damselflies (2005). This volume adds new species and new information and puts it all together in one eye-poppingly beautiful book. The introduction is educational and nicely tailored to South Africa. I was impressed by the identification guidelines outlined there, something all of our dragonfly guides should include. The species accounts include information on size, distribution, habitat preference, flight season, and identification. The guide really comes into its own with the illustrations, superb digital renditions of each species and sex, often with multiple examples showing variation. The known fauna includes 164 species of 12 families, and good information is presented for each family and genus and how to distinguish them from one another. South Africa, with its varied environments and numerous reserves, is very popular for ecotourism, and this guide should be in the luggage of every ecotourist heading to that wonderful destination. There are wisps and jewels and malachites and fairytails and flutterers and presbas to see!

The reader is referred to OdonataMAP, part of a general website (<http://vmus.adu.org.za>) for recording observations with photo submissions, very much like our OdonataCentral and iNaturalist, and I was impressed to find, for example, 280 records of the common *Palpopleura lucia*. There is an active group of odonate enthusiasts down there, and the Tarbotons' books have played an important part in that.

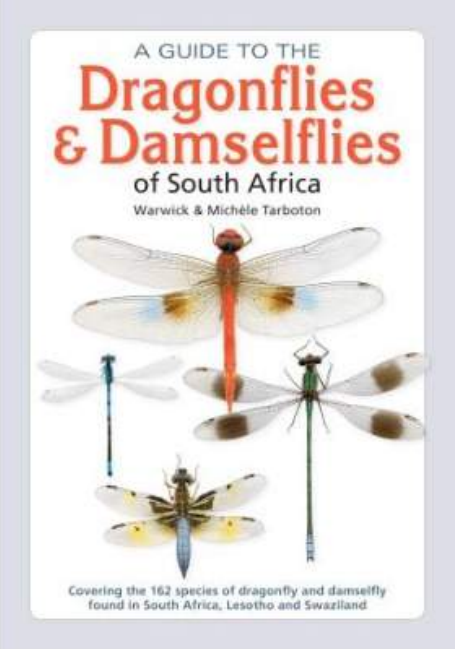


Photo Submissions for Argia

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).

Please send your photos as e-mail attachments to <editor@dragonflysocietyamericas.org> (up to 15 Mb), via a file transfer service, or in GoogleDrive, **NOT in the body of an e-mail or document!** Photos may be used in later issues, but 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 photogaph.

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, just 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>. Accompanying pictures to illustrate the tale are encouraged. Whether you are just discovering odonates this year or have pursued them for decades, I know there are plenty of interesting, entertaining, and inspiring stories out there to be told!

In this edition, Kathy Biggs describes how she fell into pond building, Odonata, and writing.

Dragonflies, Dragonfly Ponds and How I Fell into the Clutches of Odonata and Became an Author, by Kathy Biggs <bigsnest@sonic.net>

It all got started when I read an article that said you could change your swimming pool into a garden pond. I was tired of throwing chemicals into the pool and taking leaves out, so in May of 1996, we took down the above-ground walls of our pool and built a garden pond. It sits in the hole that was left where the deep end of the swimming pool had been. Little did I know that I was doing everything just right for the dragonflies.

We hadn't had the pond there but a day or two when a gorgeous big red dragonfly arrived. My 12-year-old niece had come to help us complete the pond. At first she was afraid of him, but I took her by the hand and the dragonfly let us get so close that we could see his abdomen expanding and contracting with his breathing. We were completely taken in by his gorgeous eyes and his general beauty and he became our pond mascot. That's really how it all got started, with the arrival of that Flame Skimmer (*Libellula saturata*).

Kathy and Dave Biggs' pond, September 2013. Photo by Celeste A. Searles Mazzacano.

When other dragonflies began coming to the pond, I really couldn't help but pay attention. I had been a birder, so it was only natural for me to want to identify and list them. I opened my California guide to insects, and the Audubon field guide to insects, and it quickly became apparent that I had more species of dragonflies at the pond than either of those books showed for our area in California.

I thought, "I'll go to the library and find out more!", but there weren't any guides to dragonflies there. I went to bookstores, but there weren't any dragonfly guides there either.

I finally started to find my answers on the internet (it was a teneral then!!). Ron Lyons had compiled and published an online list of the dragonfly species that occurred in California. Taking those dragonfly names, which he obtained from research done by none other than our own Dennis Paulson and Rosser Garrison, I did a search on the Internet again. I would find a site where somebody had taken pictures of a species, often Blair Nikula and Jackie Sones way across the U.S.A. in Cape Cod. Then I'd save the image on my computer and print the image out for myself on paper along with the name of the dragonfly and any information I found out about it. That's how I ended up making my own personal dragonfly guide. That first year, many a page had only a name with no information or photo. This was in 1996. I found Roy Beckemeyer online and he sent me hand-outs about dragonflies. Forrest Mitchell and James Lasswell in Texas began live scanning dragonflies and I remember waiting 10 minutes to watch that Neon Skimmer (*L. croceipennis*) download. It was so exciting!! Then Dennis Paulson put up his scans of mostly western dragonflies and I was able to learn so much more.

So, by 1998, we were searching in the mountains for species that don't occur in the valleys, and in the desert we saw other species. There were some that were more eastern and some that were more western in their distribution. We went to all those places and discovered so much. My husband and I were both having a blast. It was so much fun.

In the summers we chased the dragonflies all over and during the winters I studied about them. I learned so much ("learning keeps you young"). Soon I started attending the Fourth of July Butterfly Counts and other such events

as a way to get into more waterways. Folks would see me with my Ode guide binder and I started getting requests to make copies of it. But I couldn't do that as the images in it weren't taken by us.

Now, I realized that others wanted to learn about the dragonflies too. So just before our youngest son went off to college, I had him show me how to create a simple web site. I was a teacher and it was just natural for me to want to share the knowledge I was gaining. I began by creating a web site for the Dragonflies of California and that's pretty much all I did that winter. Little did I know it would take over my life and that I would become an author!

I began the web site by adding common names to the list of scientific names that Ron Lyons had compiled. These names didn't even exist before November 1996. Our far-sighted group, the Dragonfly Society of the Americas (DSA), didn't want to have happen what had happened with butterflies and plants, i.e. wherever you went there's a different common name for each species. So DSA put together a naming committee, which came up with names for all the dragonflies in the U.S., and then the committee came back to the membership, which voted on them. The selected names are working beautifully and I was able to use them both on my web site and in my book. The committee tried to pick names that went with each species' appearance or behavior. An example would be the Widow Skimmer (*Libellula luctuosa*); it has black on the inside half of its wings as if it were wearing a cloak for mourning. I think that the naming committee was very successful.

A least one name the committee chose was misleading, though. The California endemic *Zoniagrion exclamationis* was named the Sierra Damsel. To out-of-staters, that name conjured up images of California, but to Californians, it brought to mind the Sierra Nevada Mountain range. Not knowing that Dennis Paulson, who had become my mentor, was on the naming committee, I complained to him that I had had great difficulty in making my very first independent dragonfly identification as I was looking at a valley species, so I'd not even bothered to look up what a "Sierra" damsel might look like. He then said something to the effect of "I'm on the naming committee and this first year the committee will entertain any suggested changes." He encouraged us Californians to come up with a more suitable new common name, and some of us (myself, my husband Dave Biggs, Tim Manolis, and Andy Rehn) threw around names all winter. Each name we chose was already taken, though; they like dappled shade, for example, but Shadow Damsel was already in use for *Palaemnema domina*. Finally we thought, it has two blue exclamation marks atop its thorax and its scientific name includes *exclamationis*, why not name it the Exclamation Damsel? It was a mouthful, but we submitted that name to the committee. The vote was not unanimous, but it prevailed and now I'd had a part in naming one of these gorgeous creatures. This was exciting.

Neon Skimmer (*Libellula crocipennis*). Photo by Forest Mitchell.

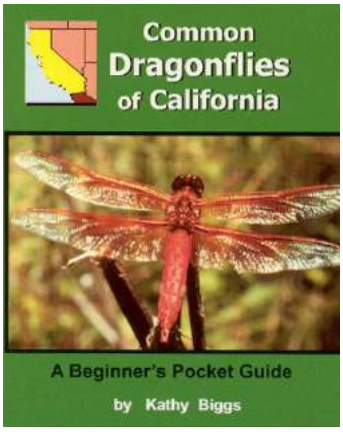
Exclamation Damsel (*Zoniagrion exclamationis*). Photo by Dave Biggs.

I kept working on the website and it grew and grew. Every time my friends would call or stop by, that's what they'd find me doing. Soon, teasingly, they asked "When will it be a book?". Well, that put the idea in my mind, and come the winter of 1998, when Ode withdrawal began, I found that working on a guide was just the tonic I needed. The first version of my Common Dragonflies of California was only 77 pages long and totally made on our home computer and printer. I think I sold 45 copies to folks through the website who asked for it. Dennis Paulson was kind enough to do the scientific review of it for me, and cautioned me not to be discouraged when I saw all his red ink on the review. That winter I looked for a publisher, but didn't find one.

In 1999, Dave and I formed our own publishing company, Azalea Creek Publishing (the name of the creek at the back of our property). I felt I knew what a beginner needed and expanded the book to 96 pages while still keeping it pocket-sized. Bob Behrstock had become an

"e-friend", and he contacted me about coming to California to photograph our Odes. I said I'd be glad to show him around and I had him send me a list of 'target' species. It turned out to be a wonderful encounter in many ways, for I soon realized that our own photographs just weren't of sufficient quality for a guide. When I timidly asked Bob if I could use some of the photos he took during his visit, he said YES!! The quality of the guide grew tremendously. Later, Bob asked me what my "totem" ode was. I had to think about it, but soon realized that it was that very first species that I identified on my own, the Exclamation Damsel. And you may have noticed that I always use two exclamation points, not just one!!

I became quite busy scanning slides for the book. I had to go to nearby Sonoma State University to do this as we certainly didn't own a slide scanner. I joined BAIPA (Bay Area Independent Publishers Association) and was soon in touch with a printing company in China, having learned that almost all color printing was done there or in Germany, as U.S. printers at the time didn't have the newest machines. I was able to talk Dennis Paulsen into doing another scientific review and we were in business. Of course, the Flame Skimmer was the cover odonate for the 1st edition. The image had been taken by my brother, Bob Claypole, back in 1974. Little did he or I suspect how many people would see that image!!



But, how was I to know how many copies to make? I met with the owner of the local bookstore, showed him my mock-up copy and asked him to predict how many copies he thought he could sell in a year. Then I multiplied that by the 58 counties in California and decided on 5000 copies. We took funds for the printing out of our savings account and crossed our fingers. Well, the rest is history. We sold those first 5000 copies the first year and we've now sold over 17,000 copies of that little guide, its 2nd edition and the expanded southwest edition, plus we've published a Dragonfly Coloring Book (with art by Tim Manolis), a Greater Southwest Guide, and we've even published a few books by others that weren't Ode-related. BTW: My 1st guide turned out to be the 2nd best selling non-fiction book for the local bookstore that first year!!

Now I travel around not only chasing dragonflies, but also giving programs and workshops about them. It's been a wild ride and I'm still just loving it!! See you at the next DSA meeting!?

Correction

In "A Challenge" (Bailowitz et al., Argia 28(1), pg. 13), the authors stated that the Christmas Bird count is scheduled for a time when birds are most stationary. DSA member Bob Honig of Texas pointed out that "The CBC count period in fact is still a time when birds on a population level are actively moving southward (source and additional details: National Audubon Society info for CBC Compilers at <http://www.audubon.org/conservation/christmas-bird-count-compiler-resources>)".

Bob added that "bird populations are still in considerable flux during this period, and that the most stable period for wintering birds in North America comes later, maybe late January or very early February. CBCs occur around Christmas because the original purpose in 1900 was to present an alternative to the side hunt, a then-popular Christmas Day competition to shoot as many birds as possible, resulting in many thousands of birds killed (see <http://www.audubon.org/conservation/history-christmas-bird-count>). A benefit for recruiting CBC observers is that more people are available during that period due to winter vacations; and having the CBC during the same period every year for so long has resulted in an extraordinarily valuable historic record."

Thank you for the additional details and history, Bob—the authors and Editor appreciate this clarification!

Cultural Odonatology

Cultural Odonatology is a new reader-suggested feature in 2016 that is intended to focus on different aspects of the human relationship with odonates, showcasing dragonflies in art, architecture, literature, legend, and poetry, and may contain discussions of odonates in existing works or original works. The DSA membership is as diverse as the insect order we all love, and we approach the Odonata as scientists, educators, naturalists, artists, poets, photographers, essayists, bloggers, and more, with many wearing several of these hats. Please share any ideas and feedback about this feature with me at <editor@dragonflysocietyamericas.org>.

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>, along with a short note describing the photo, location, and event.

In this episode. J.K. "Quack" Quackenbush describes being in the right place at the right time.

To the victor goes...lunch, by J.K. Quackenbush <paleoquack@gmail.com>

I was walking along a cranberry bog edge at Massasoit State Park in Taunton, Massachusetts, hunting dragons. I noticed the start of the slow flight upwards of a fly, and then a much quicker figure rose from a nearby stem. The flight paths immediately merged, becoming one, and the meadowhawk (*Sympetrum*) landed on this stem just below me. I was already sliding down the embankment, camera

at the ready, and was fortunate to have the perfect lighting. Moments after the shot the meal was done, and off it went.

The Passing of a DSA Member

A few days before this issue of Argia was published, the Editor was notified that Bill Flynt, II had just passed away. Bill is the co-auther and photographer for the article in this issue "Seaside Dragonlet (*Erythridiplax berenice*) Population on Bitter Lake National Wildlife Refuge in New Mexico" and a regular contributor to Argia. Our sincere condolences to Bill's family and friends—he will be missed.

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.

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 the Dragonfly Society of the Americas

Membership in the DSA is open to any person in any country and includes a digital subscription to Argia. Dues for individuals in the US, Canada, or Latin America are $15 US for regular memberships (including non-North Americans), institutions, or contributing memberships, payable annually on or before 1 March of membership year. The Bulletin Of American Odonatology is available by a separate subscription at $20 US for North Americans and $25 US for non-North Americans and institutions. Membership dues and BAO subscription fees should be mailed to Jerrell Daigle, 2067 Little River Lane, Tallahassee, Florida, USA 32311. More information on joining DSA and subscribing to BAO may be found at <www.dragonflysocietyamericas.org/join>.

Mission of the Dragonfly Society of the Americas

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

Back cover: **(upper)** Lilypad Clubtail (*Arigomphus furcifer*) near Crow Wing River, Nevis Township, Hubbard County, Minnesota, 17 July 2015. Photo by John Weber. **(lower)** Blue-eyed Darner (*Rhionaeschna multicolor*) at a small retention pond in La Crosse County, Wisconsin, taken on the same date that oviposition by this species at the site was confirmed, 29 June 2015. Photo by Dan Jackson.