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**Front cover:** “There was lots of action at last year’s annual meeting in Wisconsin. In mid-afternoon of 19 June 2014, on the banks of the Chippewa River at Bruce [Rusk County], making their formal debuts into adult society were dozens of Dragonhunters (*Hagenius brevistylus*). It was a heart-stopping event for a naturalist to witness.” Photo by Marion Dobbs.

## 2015 Annual DSA Meeting in State College, Pennsylvania, 25–28 June, and Call for Abstracts

Hal White <halwhite@udel.edu> and Bryan Pfeiffer <bryan.pfeiffer@uvm.edu>

The 2015 Annual Meeting of the Dragonfly Society of the Americas will be held in State College, Pennsylvania from 25–28 June. Betsy Leppo is the organizer, along with a large group of assistants. The meeting will be a great opportunity to showcase and explore several rich Odonata habitats in central Pennsylvania where there are bogs, streams, lakes, and a variety of habitats where *Cordulegaster* (spiketails), gomphids (clubtails), cordulines, and many other interesting species may be found. Featured areas include Bear Meadows (White, Beatty, and Beatty, 1968), Ten Acre Pond (Shiffer and White, 2014), Black Moshannon (Shiffer, Leppo, and White 2014), and others where over 100 species combined have been reported over the years. Explore the haunts of the Gray Petaltail (*Tachopteryx thoreyi*), delight in the beautiful blue eyes of the Spatterdock Darner (*Rhionaeschna mutata*), and see if the River Bluet (*Enallagma anna*) is still present at the only site in Pennsylvania where it is known.

The indoor conference sessions will be held at the Ramada Inn on Saturday 27 June, with local field trips on Friday and Sunday and additional two-day pre- and post-conference field trips. (check back to the the web site below for details on these excursions.) Forty rooms have been reserved for four nights, 25–28 June (Thursday–Sunday) at the Ramada Inn. Participants need to make reservations by 25 May 2015 to be guaranteed availability and rate. After that date, rooms will be released to general inventory but the Ramada will still honor the rate after that date, if rooms are available. We have reserved 25 rooms with two double beds and 15 rooms with one king bed. The cost is \$79.00 per night plus tax. Mention that you are with the Dragonfly Society of the Americas in order to receive the group rate. Note that there is a complimentary hot buffet breakfast available for guests, but on weekday mornings only.

The dragonfly fauna of central Pennsylvania has been sampled frequently for more than 70 years. George H. Beatty moved to the State College area in 1955 and lived there with his wife, Alice Ferguson Beatty, also an Odonata specialist. They and co-authors published fourteen papers on Pennsylvania Odonata between 1968 and 1971 of which several relate to central Pennsylvania. The Beatty's large Odonata collection is now housed at Pennsylvania State University's Stuart W. Frost Entomological Museum. The collection will be available to visit during the meetings.

Details and many relevant links are available on the conference home page at <<https://sites.google.com/a/udel.edu/nedsa/home/2015>>. Among the unique features of the web site this year are links to the location and dates recorded for the 107 species of conservation concern in Pennsylvania and access to >50,000 records of Pennsylvania Odonata observations in notebooks maintained by Clark Shiffer. For those who want to explore on their way to and from State College and wishing to find particular species or visit interesting sites not on the official agenda, these are great resources to study prior to the meetings.

### Call for Abstracts

The DSA Abstract Review Committee is seeking submissions for short oral presentations to be delivered during the single day reserved for presentations and DSA business on Saturday 27 June. We welcome presentations on almost any topic consistent with the DSA's mission to advance "the discovery, conservation and knowledge of Odonata through observation, collection, research, publication, and education." These presentations, which should run no more than 20 minutes, are not limited to peer-reviewed, published research, although that too is certainly welcome.

## Calendar of Events

*continued next page...*

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

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

*continued from previous page...*

Presenters should send an abstract consisting of no more than 250 words to Bryan Pfeiffer at <bryan.pfeiffer@uvm.edu> no later than 1 April 2015. Abstracts should follow this general format:

- 1) A general and practical opening: What's the purpose of the research or presentation? Why do we care?
- 2) Methods: A brief description of experiment design, field investigation, lab work, or other relevant work.
- 3) Results
- 4) Conclusion


The above items should all be written in the active voice. The DSA Abstract Committee (members listed below) will review each abstract and may suggest that the author make revisions. The Committee has the prerogative to reject presentations inconsistent with the DSA's mission. We look forward to seeing you in June. Thanks!

For the Abstract Committee, Bryan Pfeiffer

The DSA Abstract Review Committee:

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- Shiffer, C.N., B. Leppo, and H.B. White. 2014. Odonata of Black Moshannon State Park, Centre County, Pennsylvania, *ARGIA* 26(4): 8–15.
- Shiffer, C.N. and H.B. White. 2014. Dragonfly and damselfly colonization and recolonization of a large, semi-permanent Pennsylvania pond. *Northeastern Naturalist* 21(4): 630–651.
- White, H.B., G.H. Beatty, and A.F. Beatty. 1968. The Odonata fauna of Bear Meadows, a boreal bog in central Pennsylvania. *Proceedings of the Pennsylvania Academy of Science* 42: 130–137. 

## 2015 Southwest Dragonfly Blitz, 27–30 August

Kathy Biggs <bigsnest@sonic.net>

The 2015 Southwest Dragonfly Blitz will take place across 27–30 August, and will be headquartered at the City of Rocks State Park, which is located in Sierra County, southwest New Mexico (<<http://www.emnrd.state.nm.us/SPD/cityofrocksstatepark.html>>). Our hosts and field trip leaders will be Tony and Shela Godfrey (<[artfullbirds@yahoo.com](mailto:artfullbirds@yahoo.com)>). The blitz is being coordinated by Kathy and Dave Biggs (<bigsnest@sonic.net>).

The gorgeous City of Rocks State Park is located about halfway between Deming and Silver City, both of which have motels for those flying in and others not wishing to camp. The park is within a few miles of Dashed Ringtails (*Erpetogomphus heterodon*), Arizona Snaketails (*Ophiogomphus arizonicus*), and other unique southwestern species, including some that are not found too much further west such as Halloween Pennant (*Celithemis eponina*), Checkered Setwing (*Dythemis fugax*), Eastern Ringtail (*Erpetogomphus designatus*), Painted Damsel (*Hesperagrion heterodoxum*), Riffle Darner (*Oplonaeschna armata*), and the superb Filigree Skimmer (*Pseudoleon superbus*).

We will spend an entire day searching for odes in the Gila Wilderness Area, which is also where we can find Arizona Snaketail. This vast area was preserved as the first wilderness area in the world, thanks to the efforts of Aldo Leopold and President Theodore Roosevelt. Participants will



Blitz image created by Kathy Biggs. Original dragonfly photo by Bob Behrstock. City of Rocks State Park background by Guywets, licensed under Public Domain via Wikimedia Commons <<http://tinyurl.com/onuqhff>>.

have time to explore the magnificent Gila Cliff Dwellings National Monument and the headwaters of the Gila River.

We plan to visit other nearby areas that have cienegas and hot springs, including the area where the Godfreys found the first USA record for West Mexican Leaf-tail (*Phyllogomphoides nayaritensis*) just last year. Access to property near the park along the Mimbres River that New Mexico Game and Fish purchased last August will be opened for us, although it is not currently open to the pub-


lic. Some of the areas we'll visit have not even been explored for Odes! There are currently about 50 species recorded in Sierra County. Who knows what else we may find?

The Orion group area at the City of Rocks has been reserved for blitz participants. It includes a large group shelter with numerous picnic tables and seven spacious campsites. Vault toilets are located across the entrance from the group area. Showers and toilets are located nearby at the Visitors' Center. There are another 45 campsites nearby within the park, some of which have electrical hookups for trailers or motor homes.

Those not staying in the Orion group area should make their own reservations soon. If you are planning on coming, please let Kathy and Dave and/or Tony and Shela know so your name can be added to "SW Blitz 2015" e-mail list. Please indicate whether you plan to stay in the group area, elsewhere within the park, or at a nearby motel.

A 14-inch Meade telescope is housed in an observatory within the group area. If conditions are good for viewing and folks are interested, we may be able to arrange a star-gazing party for the evening of Saturday 29 August. Other activities or programs may be presented on one or more of the other evenings.

The nearest airport to City of Rocks State Park is El Paso, with a driving time of 2 hours, 15 minutes. Tucson is about three hours away while Albuquerque is about four hours, but has daily flights to the nearby Grant County airport, located near Silver City.

Even if you can't commit for the whole blitz, if you live nearby in Arizona or Nevada, there will be a bunch of folks caravanning/oding their way to the blitz from California and you'd be welcome to join us on the way to and/or from the blitz. There may be similar groups arriving from the east or from the north. 

## 15th Annual Oregon Dragonfly Survey *Aeshna* Blitz

Steve Gordon <scfgordon24@comcast.net>

For the 2014 15th Annual Oregon *Aeshna* Blitz, the Oregon Dragonfly Survey group agreed to meet at Cottonwood Meadows Lake located in south-central Oregon in Lake County. Members arrived on Friday 23 August at the campground set among Ponderosa pine and mixed fir adjacent to the lake. This year's 10 participants were Steve Berliner, Sherry Dauber, Steve Gordon, Jim Johnson, Cary Kerst, Ron Lyons, Steve Valley, and Josh, Michelle, and Xabrina Vlach. The Blitz timing and destination are established in late winter each year at a coffee shop in Albany. The Blitz objectives are: 1) to get into the field during the prime time to observe darners and other odonates, and 2) to investigate different parts of Oregon.

Cary Kerst and Steve Gordon left for the Blitz on Tuesday 19 August and their first stop was the Salt Creek outlet at Gold

Lake in Lane County. *Octogomphus specularis* (Grappletail) were absent this late in the season, but they recorded *Aeshna palmata* (Paddle-tailed Darner), *Somatochlora albicincta* (Ringed Emerald), and *Ophiogomphus morrisoni* (Great Basin Snaketail). At Crescent Creek in Klamath County, they found more *O. morrisoni*, a single *Libellula forensis* (Eight-spotted Skimmer), two *Sympetrum danae* (Black Meadowhawk), *A. palmata*, and *Lestes disjunctus* (Northern Spreadwing). At Kimball State Park along the Williamson River, they found no odonates. At the Lava Beds National Monument campground, Cary and Steve concluded that despite a warmer and drier than normal Oregon summer, the odonate season was coming to an early end. The only *Aeshna* species recorded the first day was *A. palmata*.

On Wednesday 20 August, Cary and Steve toured Tule Lake National Wildlife Refuge and then headed east through Bonanza, Beatty, and Bly and searched possible bodies of water in the Lofton Lake region. Many spots were dry and full of cattle. At the Sprague River Wayside in Klamath County, *A. palmata* were common and one *Cordulegaster dorsalis* (Pacific Spiketail) was observed. Cary and Steve spent the night in Lakeview, where the motels and restaurants were busy hosting fire fighters. During the stay in Lakeview, they witnessed many travelers headed toward the Black Rock Desert in Nevada for the annual Burning Man Gathering. These folks were easy to spot in old Volkswagon vans, restored school buses, and rental trucks. At a local cafe, a local rancher turned from his breakfast on his sturdy



*Aeshna palmata* (Paddle-tailed Darner) in flight. Photo by Ron Lyons.

stool and remarked, “Here they come again. All the local business people think they’re going to get rich off these Burning Man folks. But the rich people don’t pass through Lakeview.”

On Thursday 21 August, Cary and Steve searched along Twenty-mile Creek south of Adel and found *Aeshna walkeri* (Walker’s Darner) and *Argia agrioides* (California Dancer) at the “Ford” crossing on the creek. Heading back downstream, they stopped at the only known Oregon location for *Argia nahuana* (Aztec Dancer). They were surprised to find that the nature of the creek was dramatically changed from the previous year. Beaver dams had transformed the ankle-deep rocky waters into a series of thigh-high ponds. Along the creek and near the hot springs on the east side of the Creek, Cary and Steve each handled approximately 20 *Argia* individuals and all were *A. nahuana*; they found no *A. agrioides* (California Dancer). Perhaps the habitat alternation has created a situation more favorable to the *A. nahuana*, as at a stop at the same spot the previous year the two species were present in about equal numbers.

At this location, *Libellula saturata* (Flame Skimmers) were common, as were *A. palmata* and *Argia vivida* (Vivid Dancers). Cary netted one *Archilestes californica* (California Spreadwing), and at the water gauging station further downstream, he found *Argia lugens* (Sooty Dancer). Before heading to Cottonwood Meadows Lake, they stopped at



Night Snake. Photo by Cary Kerst

the store in Adel, and by the side of the parking lot they found a dead *Hypsiglena torquata* (Night Snake). They were both interested in this nocturnal reptile that neither had seen before.

On the way to the Blitz on 22 August, Jim Johnson found *Argia agrioides* (California Dancer) at Fishhole Creek, a new record for Klamath County (OdonataCentral OC #426745). On 22 August, Cary Kerst and Steve Gordon arrived at Cottonwood Meadows Lake and spent two hours along the shore, recording 12 odonate species.

At an elevation of 6,139 feet (1,871 meters), Cottonwood Meadows Lake is a beautiful spot. Its main purpose appears to be recreation, and the water level was high. The west end of the lake has a marsh and wet meadow, which was a nice spot to look for dragonflies and damselflies. As the group arrived at the campground and set up tents and campers, they discovered that autumn was in the air. On

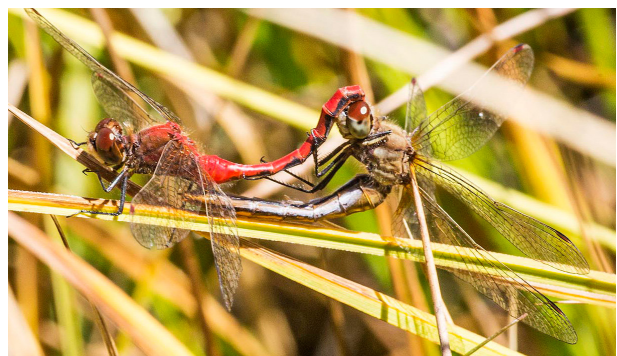


*Erythemis collocata* (Western Pondhawk) eating male *Argia nahuana* (Aztec Dancer) still connected with the female, 20-mile Creek, Lake County, Oregon. Photo by Cary Kerst.

Sunday morning, Ron Lyons recorded the temperature at 36°F. The campground was a great spot for Gray Jays and Clark’s Nutcrackers. We found five species of woodpeckers, and at night we heard Northern Pygmy-Owls and Great Horned Owls calling, as well as coyotes. One of the real treats in camp was Xabrina, who is now three years old and full of fun.

In total the group identified 17 Odonate species at Cottonwood Meadows Lake (noted on the trip checklist). Among highlights were four species of darners: *Aeshna palmata*, *A. interrupta*, *A. umbrosa*, and *Anax junius* (Paddle-tailed, Variable, Shadow, and Common Green Darner). In the marsh and meadow, dozens of *Sympetrum obtrusum* (White-faced Meadowhawk) could be found, many in the mating “wheel”.

On the way home, Ron Lyons stopped at the Bruneau Dunes in Owyhee County, Idaho and added two new county records: *Lestes congener* (Spotted Spreadwing;



*Sympetrum obtrusum* (White-faced Meadowhawks) mating at Cottonwood Meadows Lake. Photo by Cary Kerst.



Cottonwood Meadows Lake, Lake County, Oregon. Photo by Steve Gordon.

OC #426644) on 26 August and *Sympetrum pallipes* (Striped Meadowhawk; OC# 426647) on 27 August. On 26 August he added another species to the Bruneau Dunes list with *Anax junius* (Common Green Darner; OC#42665). He later found *Ischnura cervula* (Pacific Forktail) and *Argia emma* (Emma's Dancer ) back at Cottonwood Meadows Lake.

All in all, the Blitz achieved its objectives. We added a new Oregon county record. In Cottonwood Meadows Lake, we found a beautiful spot to focus our efforts. We made interesting observations both coming and going to the Blitz, and had a good time being with each other in the field. And as an added bonus, Ron Lyons added two new Idaho County Odonate records. The trip total was 31 odonate species. 🦋



2014 Aeshna Blitz Cottonwood Meadow Lake

Blitz attendees (L to R): Michelle, Xabrina, and Josh Vlach, Ron Lyons, Steve Berliner, Steve Gordon, Sherry Dauber, Jim Johnson, Cary Kerst, Steve Valley. Photo by Steve Valley.

## Cast Your Vote Now in the 2015 DSA Elections!

It's time to elect a new President Elect and Regular Member to the DSA Executive Council. Ballots are cast online through a link on the homepage of OdonataCentral at <[www.odonatacentral.org](http://www.odonatacentral.org)>. Click on the voting link and you will be taken to the ballot on the Migratory Dragonfly Partnership web site. If you are asked to log in again, you can log in to the MDP web site using the same user credentials as OC. Remember that you must be current with your 2015 DSA dues to be able to cast a ballot!

To vote, select the candidate of your choice or add a write-in candidate, then click the voting box under the person's name. You should then see a message indicating that your vote has been recorded.

All votes should be cast no later than 30 April 2015. Thank you for your participation in the DSA electoral process!

## Algal Dragonflies—Senior Citizens?

Dennis Paulson <dennispaulson@comcast.net>


When Dave Smallshire and I co-led a dragonfly natural history tour to Panama in August 2012, we were immediately struck by the prevalence of what looked like algae on the wings of some of the odonates. Dave had seen this before in Costa Rica, but I honestly couldn't recall ever seeing such a thing or reading about it.

On returning home, I got out my copy of Philip Corbet's *Dragonflies: Behavior and Ecology of Odonata* (Comstock, 1999), and sure enough, with his careful perusal of the literature, he gave a reference to a note by Ola Fincke in *Advances in Odonatology*, Vol. 11 (University of Calgary Press, 1984), about algae on the wings and thorax of some *Megalopterus caerulatus* in Panama. Ola presumed these were fairly old individuals, based on the assumption that it took a while for the algae to colonize these damselflies.

We noted algae on several species, and the *Anatya guttata* pictured here is just one such example. Dave and I are interested in finding out how prevalent algae are on tropical odonates, so if anyone else has photos of this phenomenon, please let me know and send a photo if possible.



*Anatya guttata*, Panama. Photo by Netta Smith

It's probably not possible to age odonates by their algal load, but it presumably does indicate older individuals, and we're trying to find out if there are any correlations with seasons or rainfall patterns. 

## *Somatochlora walshii* (Brush-tipped Emerald) Breeding Site in a Spring Fen in Northern Minnesota

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### Introduction

Finding breeding sites of *Somatochlora walshii* (Brush-tipped Emerald) based on observing adult reproductive behavior (pairs in wheel, ovipositing females) has proved difficult, and confirming successful breeding with collections of late-instar nymphs or exuviae has been even more challenging. To begin his 1941 description of the nymph of *S. walshii*, E. M. Walker made the following sobering statement: "For many years the nymph of *Somatochlora walshii* Scudd. has eluded our pursuit, in spite of the fact that its geographical range, unlike that of most of our *Somatochloras*, includes practically all of the settled parts of the eastern provinces and it is by no means a rare species in its special habitat—boggy streams and ditches." His nymph descrip-

tion was based on just a single male exuvia found near a newly emerged adult and a single female nymph that he reared to maturity but that died prior to emergence. Walker's difficulties in finding nymphs of *S. walshii* despite the relatively common observations of adults have been more recently mirrored by our efforts to document breeding areas of this species in Wisconsin and Minnesota. In 13 years of leading a citizen-based, state-wide survey program for odonates in Wisconsin (Wisconsin Odonata Survey; <www.wiatr/inventory/odonata>) and in conducting his own numerous Odonata surveys in a variety of peatland types, Bob has recorded observations of many adults of this species, but has found no nymphs and only a single exuvia in a Lake Superior coastal fen without flowing water anywhere nearby (DuBois et al., 2009).



Breeding sites of *S. walshii* have typically been described as small, open, clear, slow streams flowing through bogs, fens and marshes (Walker and Corbet, 1975; Dunkle, 2000; Glotzhober and Moody, 2002; Paulson, 2011), but habitat descriptions are usually based on adult sightings and collections—nymphs and exuviae have rarely been targeted and even more rarely found. Exuviae are the “gold standard” for associating a species with a water body because they indicate a breeding site with certainty and demonstrate that the species was present at all stages of the life cycle (Oertli, 2008; Raebel et al., 2010). The presence of mature (F-0) nymphs and teneral adults is also a strong indicator of successful breeding. In the most thorough investigation of the breeding habitat of *S. walshii* that we found, Glotzhober and Moody (2002) found numerous males in two nature preserves in Ohio, and collected a female with an egg cluster on her vulvar lamella at one of them, but no nymphs, exuviae, or tenerals were found. They nicely described the general habitats of the two preserves, but exact breeding sites were not found or described. Observing ovipositing *S. walshii* females or finding females with egg clusters are both good indications of successful breeding, but even those observations are less than certain because female odonates sometimes oviposit in areas where nymph survival to maturity is problematic.

Further confounding the issue, the mental image we tend to envision when we think of a slow stream—perceptible, directional water movement within defined banks—does not always square up with descriptions of habitats where evidence of *S. walshii* breeding has actually been found. For example, Whitehouse (1941) described the oviposition of *S. walshii* females in “stagnant potholes” of a drainage creek on Vancouver Island. Walker and Corbet (1975) noted that the species “avoids ponds of any sort and is also absent from streams with an easily perceptible flow.” These somewhat incongruous descriptions of the breeding habitat of *S. walshii* can present a problem for conservation biologists seeking to locate unquestionable breeding sites so the sites can be protected: the breeding habitat is described as a small, slow stream, but how does one discern the presence of a stream if it doesn’t look like one and you have difficulty perceiving any flow? Where does one even begin to look for nymphs or exuviae?

In June 2013 and July 2014, Mitch, Curt, Bob, Kurt, and Scott King worked under contract with the Minnesota Department of Natural Resources (MDNR) to conduct surveys for odonates in the Red Lake Wildlife Management Area (RLWMA) and the surrounding Beltrami Island State Forest area, together encompassing a vast (319,700 hectare), remote property in parts of three counties in north-central Minnesota. This area is rich in aquatic habitats including a variety of peatland types. By chance we got some insights

into the above questions regarding *S. walshii* breeding sites at a remote spring fen in Roseau County.

### Study Site

The study site is the easternmost of three calcareous spring fens in the Bemis Swamp (N 48.726°, W 95.447°), a ~3,200 hectare peatland located at the base of a large lacustrine sand deposit along a prominent glacial ridge (Aaseng, 2009). The study fen is comprised of three narrow corridors (water tracks) about 300 m in length and 15 to 30 m in width that form an N-shape when seen from above (hereafter called the N Fen). The area of the three water tracks was ~1.6 hectares. A series of intermittently placed pools is spaced longitudinally within these water tracks. Most of the pools are fairly small (ranging from 30 cm to 3 m long by 30 cm wide and 10–20 cm deep) but some are larger (2.5–3 m long by 1.2–1.5 m wide and 20–30 cm deep). Large mammal track lines crisscross the fen and may have formed some of the pools. Some of the larger pools in the southwest part of the fen contained a calcium carbonate precipitate (marl).

According to a Native Plant Community Classification Guide (NPCCG) produced by the Minnesota Department of Natural Resources (2003), spring fens in Minnesota (Northern Extremely Rich Fens) are open peatland discharge areas that form linear and sometimes anastomosing channels within a rich swamp forest. They typically have high pH, are rich in dissolved minerals, are much colder than adjacent surface water, and are presumably low in oxygen. Several state-threatened plant species occur in these spring fens. Because of the biologically challenging conditions that spring fens present, competition with plant species that dominate fens lacking calcareous springs is minimized. The narrow, linear water tracks through spring fens typically consist of a “head” where highly calcareous discharge water forced through the peat by artesian pressure forms open pools, and a “tail” where the discharge water flows downslope. Because of the rare hydrological conditions required for their development, only about a dozen spring fens are thought to exist in Minnesota, although surveys are ongoing in the northern counties. Spring fens are not always easy to define. Some show a gradation between Extremely Rich Fen and Rich Fen. The Bemis Swamp spring fens are the smallest known in Minnesota, the larger spring fens being 16–32 hectares in size.

The N Fen is tucked into a mostly black spruce (*Picea mariana*) and tamarack (*Larix laricina*) swamp. Upon approaching the fen, one must travel through a white cedar (*Thuja occidentalis*) wetland swamp covered in mosses and various wetland forbs. When the edge of the fen is reached, you’re greeted by showy lady’s-slippers (*Cypripedium reginae*) and small tamarack and white cedar that give way to a mostly

open water track. We did not identify all the plants in the N Fen, but according to the NPCCG, the plant community typically found in spring fens has multiple elements in addition to the above tree species. Shrub cover is sparse and may include shrubby cinquefoil (*Potentilla fruticosa*), bog birch (*Betula pumila*), and bog rosemary (*Andromeda glaucophylla*). Graminoid cover may be interrupted and dominated by tufted bulrush (*Scirpus cespitosus*) with lesser cover of fine-leaved sedges such as candle-lantern sedge (*Carex limosa*), lead-colored sedge (*C. livida*), prairie sedge (*C. prairea*), tussock sedge (*C. stricta*), and sterile sedge (*C. sterilis*). Herbs are typically patchy, with buckbean (*Menyanthes trifoliata*) often abundant, and other species may include Kalm's lobelia (*Lobelia kalmii*), American grass-of-Parnassus (*Parnassia glauca*), English sundew (*Drosera angelica*; state-threatened), round-leaved sundew (*D. rotundifolia*), and small cranberry (*Vaccinium oxycoccos*).

The water, rich in calcium, is what makes the N Fen a special place. Testing a water sample we collected from one of the deepest pools at the southwest ("head") end of the fen on 28 July 2014 gave the following results: temperature 55.6°F; pH 6.9; conductivity 0.305 mS/cm; pHmV (voltage proportional to the pH of the water solution) -23.5; dissolved oxygen 4.33 mg/L; % dissolved oxygen 41.1. Results from a sample near the NE ("tail") end of the fen were similar. Measurements from a similar spring fen several km further west in the Bemis Swamp were: pH 7.6; conductivity 257 mg/L; color 0.119; alkalinity 3.53.

### Sampling Methods and Results

On 19 June 2013 Mitch, Kurt, Curt, and Bob hiked into the N Fen to sample for odonates. We stumbled through an interminable expanse of dense forest and thick bosky growth, finally emerging into the fen at about noon. The day was mostly sunny and warm (79°F), but the water was as chilly as advertised (49°F). We did not initially discern any water movement through the fen. Mitch, Curt, and Kurt scoured the area with aerial nets to sample for adult odonates while Bob used a dip net to sample for nymphs in the small pools within the *Sphagnum* mat. Initial thoughts were that we would find peatland species of *Somatochlora* (Striped Emeralds) typical for the region (primarily *S. franklini*, Delicate Emerald) but the first *Somatochlora* nymphs collected had dorsal hooks and were tentatively determined in the field as *S. walshii*. Bob expressed surprise in finding *S. walshii* in a peatland without flowing water to Mitch, who noted that the water was indeed flowing! We stepped back to observe more carefully because our weight was depressing the *Sphagnum* mat in the area, causing a confounding movement of water. Sure enough, a barely perceptible flow was moving through the water track. We collected six nymphs of *S. walshii* (4 F-0, 1 F-1, 1 F-2) as well as six nymphs

of *S. franklini* and one nymph of *Aeshna sitchensis* (Zigzag Darner) from a number of pools within the water tracks during several hours of netting. The pools where nymphs were found were lined with *Sphagnum* mosses and a number of species of *Carex* sedges. The most productive pools were 0.5 m<sup>2</sup> or less in surface area and an estimated 20–30 cm deep. Nymph determinations of *S. walshii* were confirmed by rearing three females to emergence (specimens are housed in the Odonata Collection of the Wisconsin Department of Natural Resources, Superior, Wisconsin). Adult Odonata sampled at the site included *Coenagrion resolutum* (Taiga Bluet), *Nehalennia irene* (Sedge Sprite), *Epithecya cynosura* (Common Baskettail), *E. spinigera* (Spiny Baskettail), *Leucorrhinia intacta* (Dot-tailed Whiteface), and *Libellula quadrimaculata* (Four-spotted Skimmer).

On 28 July 2014, Mitch, Curt, Jason Haag, and Michael Read returned to the site at mid-day to sample for odonates later in the season than the previous year. The day was sunny and warm (75°F) and the water temperature was 58°F. We entered the fen in the northwest corner after an arduous walk through a quaking aspen (*Populus tremuloides*) regeneration site. Adult *Somatochlora* were evident as they cruised high off the ground among the trees. They were easily spooked from their haunts along a black spruce and tamarack tree line that bordered the water track. Jason and Michael saw several female *S. franklini* and possibly other emerald species fly from the trees along the water



Sampling for nymphs of *Somatochlora walshii* (Brush-tipped Emerald) in the N Fen. Photo by Curt Oien.

track to oviposit in small pools. This behavior complicated attempts to net them as they would practically disappear amongst the mosses and sedges at the pool edges. It is likely that several emerald species were flying at this site, but only two female *S. franklini* and one teneral female *S. walshii* were caught. The larger pools held nymphs of *Aeshna sitchensis* and *A. canadensis* (Canada Darner) along with a number of species of dytiscid beetles. One nymph of *S. franklini* was taken, but no nymphs or exuviae of *S. walshii* were found. Pools with a noticeable amount of marl were devoid of nymphs. Other adult odonates sampled there included *Lestes disjunctus* (Northern Spreadwing), *L. forcipatus* (Sweetflag Spreadwing), *L. unguiculatus* (Lyre-tipped Spreadwing), *Nehalennia irene*, *Aeshna eremita* (Lake Darner), *A. interrupta* (Variable Darner), *A. sitchensis*, *S. franklini* (pair ovipositing), *Sympetrum obtrusum* (White-faced Meadowhawk, hundreds present), and *S. internum* (Cherry-faced Meadowhawk). Specimens are in the personal collection of M. Haag in Delano, Minnesota.

Curt and Mitch also visited the Lost River Spring Fen (LRS Fen) in Koochiching County in late July 2014, which is one of the largest and best developed spring fens in Minnesota and has numerous rare plant species. We thought similar success would be had in finding rare odonates in the spring fen channels there. A single early instar nymph of the rare *Somatochlora forcipata* (Forcipate Emerald) was found in an unusual habitat among *Sphagnum* hummock pools. This species had been recorded in Koochiching County previously, but it is rarely abundant, even in ideal habitats. However, no *S. walshii* were found at this site, even though the water chemistry and physical characteristics of the N Fen and LRS Fen were similar. The water tracks of the LRS Fen had a lot of marl precipitating out of solution, forming thick colloidal suspensions. Because of these marl suspensions, the LRS Fen seemed to have very little flow (perhaps none), which may explain why no *S. walshii* were found there. In contrast, the discharge water in the N Fen had less marl precipitating out, which may have been linked to more favorable nymph habitat.

## Discussion and Summary

The N Fen in the Bemis Swamp was a successful breeding site for *S. walshii* in 2013 (four F-0 nymphs collected) and in 2014 (one teneral ♀ found). Nymphs were found in small pools up to about 30 cm deep that were arranged longitudinally through the water tracks of the fen. This cold, alkaline peatland is a very rare habitat type in Minnesota that represents just a tiny fraction of the aquatic habitats in the state. The N Fen should continue to be protected because of its rare combination of physical, chemical, and biological elements, and any development that could affect the hydrology of the site should be carefully managed to

minimize adverse impacts.

The breeding habitat used by *S. walshii* in the N Fen was generally similar to the apparent breeding habitats at two nature preserves in Ohio described by Glotzhober and Moody (2002) as high quality alkaline fens. One of the nature preserve fens was described as appearing to be fed by ground water flow from the base of a hill, which may be similar to the water source of the N Fen. A mat of *Sphagnum* moss was also present there. Other habitat characteristics at both Ohio nature preserves included the presence of marly, alkaline clay, water with almost imperceptible flow, and diverse wet sedge meadows comprised of a variety of fen species. Glotzhober and Moody (2002) also cited two personal communications that described *S. walshii* habitat in a permanent *Sphagnum* marsh in New Jersey and an alkaline fen in western Pennsylvania only 21 km east of one of the Ohio fens. The authors noted that the habitat conditions at both of these sites matched those of the two apparent breeding sites in the Ohio nature preserves.


A synthesis of habitat conditions at the N Fen and the sites cited by Glotzhober and Moody (2002) therefore includes almost imperceptible flow of alkaline, often cool groundwater through diversely vegetated sedge meadow fens having intermittent pools that may reach or exceed 30 cm in depth and will usually include mats of *Sphagnum* mosses. The hydrologic conditions at breeding sites may lead to the development of marl, but individual pools with thick colloidal suspensions of marl are not favored by nymphs. Although water is moving through these fens, the habitat may lack both defined banks and continually visible surface flow and therefore may not appear to be what is conventionally considered to be a stream.

## Acknowledgments

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## The Saffron-winged Meadowhawk (*Sympetrum costiferum*) in Oklahoma

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Adults of many meadowhawk (*Sympetrum*) species are notoriously late-season fliers, so much so that in northerly regions various meadowhawks typically are among the last species active before the onset of winter. This situation differs slightly on the southern Great Plains; in some years, late autumn brings northerly meadowhawks into the state, with the Cherry-faced Meadowhawk (*S. internum*) being the principal sporadic “invader” (Smith-Patten and Patten, 2013), and the White-faced Meadowhawk (*S. obtrusum*; Smith-Patten and Patten, 2013) and Striped Meadowhawk (*S. pallipes*; OC #426895) have appeared once each during those “invasion” years.

To these species we may now add the Saffron-winged Meadowhawk (*S. costiferum*). On 15 October 2014, we discovered three ♂ at Lake Ponca in Kay County, in the north-central part of Oklahoma ~30 km south of the Kansas state line (Fig. 1). We photographed one (OC #427449) and collected two (Smith-Patten/Patten Collection #1453 and #1454). All three individuals occupied a small, spring-like pond at the southern edge of the main lake. Later that same day we observed, but could not document, another ♀ at Legion Park in Blackwell, Kay Co. We traveled back to Norman that evening secure in the knowledge that we had discovered a first state record.

But things are never so simple. Two days later, after our specimens were processed and ready to be filed, MAP decided to examine the hamules in direct comparison to

those of the Autumn Meadowhawk (*S. vicinum*), chiefly as a learning experience, and because one could argue that in North America this is the species most likely to be confused in the field with *S. costiferum*. We are happy to report that the hamules of our specimens confirmed the identification as *S. costiferum*. We are chagrined to report that ours was not actually a first for the state, as MAP noticed that three specimens donated to us by Jason R. Heinen as *S. vicinum* did not appear to be that species. These specimens were a ♂ and ♀ from Three Lakes, in neighboring Grant County, 11 October 2012 (SP 507, SP 508), and a ♂ from Legion Park in Blackwell, 15 October 2012 (SP 509). MAP quickly determined that each specimen was indeed *S. costiferum*. Photographs of the two ♂ had been submitted to OdonataCentral (Grant: OC #382090; Kay: OC #382107) and confirmed as *S. vicinum*, but the photos clearly show ♂ *S. costiferum*, and so we have corrected the identification of those individuals.

Remarkably, the very next day, 18 October 2014, MAP visited the city reservoir in Altus, Jackson County, in the southwestern corner of the state (hence, quite far from the previous records; Fig. 1), where he was surprised to discover a single ♂ *S. costiferum* (SP 1459; OC #427492) among the numerous Variegated Meadowhawks (*S. corruptum*). This record suggests to us that the species may occur anywhere in the state during its incursions. Moreover, the Jackson County record (34.66°N latitude) is likely the southernmost ever for the species. In the literature it is bested only by

a report from Eddy County, New Mexico (32.46°N; Evans, 1995; Donnelly, 2004; Abbott, 2005; Paulson, 2009), but as James N. Stuart noted in comments on the dot map entry on OC (#252757), the claim “is apparently based on specimen(s) in [the] Colorado State University collection... [yet] Bill Prather (pers. comm., 24 Sep 2013) notes that in the CSU collection ‘there is a [♀] specimen (in bad shape) labeled *Sympetrum costiferum* from Eddy County, NM, that has an obvious *S. vicinum* subgenital plate remaining.’ A verified record of this species for Eddy Co. and for New Mexico may be lacking.” Stuart affirmed this point via e-mail (pers. comm., 30 December 2014), and so we feel that the species ought to be removed from the New Mexico state list.

We have a sample size of only two years, but nevertheless we wish to highlight that both years *S. costiferum* reached Oklahoma coincided with small incursions of *S. internum*, a species not recorded annually in the state. We posit that northerly meadowhawk species co-occur, such that the rarer species—*S. costiferum*, *S. obtrusum*, *S. pallipes*—appear when prevailing weather conditions favor an incursion of *S. internum*. Data across future years will be needed to test this hypothesis, but it would be wise to watch for Ruby (*S. rubricundulum*), Black (*S. danae*), and perhaps Red-veined (*S.*

*madidum*) Meadowhawks during flight years of *S. internum*.

### Acknowledgments

Many thanks to Jim Stuart for insight on the New Mexico record and to Jason Heinen for so carefully documenting his 2012 records, which ensured a correct identification in 2014.

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Figure 1. Records of the Saffron-winged Meadowhawk (*Sympetrum costiferum*) for Oklahoma.

# Odonata of Beaver Dam, Huntingdon County, Pennsylvania: A Record of Faunal Succession in a Changing Habitat

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## Abstract

Beaver Dam pond, created in the 1930s by damming Shaver Creek, was destroyed by floods in the mid-1960s and early 1970s, leaving a large wet meadow surrounded by forest and fed by Shaver Creek and numerous springs and seep tributaries. The Odonata fauna of this habitat in central Pennsylvania was first sampled in 1954 and has been revisited over 600 times since, mostly in the past three decades. The habitat succession has resulted in faunal changes. Aside from supporting populations of several Odonata species of conservation interest, it is remarkable in that the River Bluet (*Enallagma anna*), a damselfly with western affinities, colonized the site in 2006, the only known location for the species in Pennsylvania and south and east of southeastern Michigan and southern Ontario. We report the yearly and seasonal distribution of the 99 species documented at Beaver Dam and associated stream and wetlands through early 2011.

For the past 65 years at least one Odonata specialist has called central Pennsylvania home and has regularly sampled the Odonata local fauna at a number of interesting habitats. As a consequence, the local diversity, population stability, and changes over time are fairly well documented (Beatty and Beatty, 1971; Beatty, Beatty, and Shiffer, 1969; Beatty, Beatty, and White, 1969; Shiffer and White, 1995, 2014; Shiffer, Leppo, and White, 2014; White, 1963, 2006). Here we add to this record and describe the Odonata fauna at Beaver Dam (also known as Beaver Pond or Pine Swamp) in Huntingdon County, Pennsylvania.

## Description of Beaver Dam

Beaver Dam meadow (Fig. 1A–D), is located about six miles south of State College in northern Huntingdon County, Pennsylvania (N 40°42.7, W 77°52.8) at an elevation of 380 m (1290 ft). Numerous springs and seeps on the south side of Tussey Ridge form the headwaters of Shaver Creek, which winds its way southwest about 12 miles before emptying into the Juniata River at Petersburg. In the 1930s the Civilian Conservation Corps constructed a dam on Shaver Creek near its headwaters, forming a small lake (Beaver Dam) of about 2.7 hectares (6.7 acres) with shallow margins and abundant emergent vegetation. In the mid-1960s a flood washed out the dam, leaving a wet meadow fed by

numerous springs. A subsequent major flood in June 1972, caused by the remnants of Hurricane Agnes, further eroded the breach in the dam.

Although the Pennsylvania Game Commission planned to repair the dam to encourage duck hunting, those plans were abandoned when it became known that a robust population of the Sable Clubtail (*Gomphus rogersi*) existed in the stream that flowed through the meadow there. The dam was never repaired and successional forest growth has taken over in dryer parts of the meadow. At various times, visitors have moved rocks to create a low dam and stepping stones that have raised water levels, maintaining a small pool just before Shaver Creek exits the meadow. Beaver Dam meadow is now part of the Rothrock State Forest. A series of aerial photographs from 1938 to 2012 (Fig. 2) show this transition from a pond to an herbaceous marsh.

## Early Records and Survey Methods

The variety of microhabitats combined with succession has supported a diverse and changing Odonata fauna that was sampled intermittently between 1954 and 1981, more regularly between 1982 and 1998, and then intensively from 1999 through 2010 by C.N. Shiffer. In 1986 and 2005 the Dragonfly Society of the Americas held regional meetings during which Beaver Dam was visited by numerous dragonfly specialists. Other than a passing mention of Beaver Dam meadow in reports of those meetings (Dunkle, 1986; Pfeiffer, 2005) and a short note on C.N. Shiffer's discovery of the River Bluet (*Enallagma anna*) at Beaver Dam (White, 2006), very few publications, if any, specifically cite this location of particular Odonata diversity where as many as 70 species have been recorded in a single year (Table 1).

The first Odonata records from Beaver Dam come from a few specimens collected in 1954 by Stuart Frost, for whom the Pennsylvania State University Entomological Museum is named. Many of the species recorded before the dam washed out, like Frost's, are based on specimens collected and not on field notes that would list species seen in addition to those collected. Consequently, our knowledge of the earlier fauna is limited and fragmentary, but nevertheless provides a snapshot of the Odonata present at that time.

Because of varying weather conditions, time of year, and

personal circumstances, there was not a standard survey method other than to attempt to record every species seen and make qualitative estimates of abundance during a visit. The site is small enough to be covered easily in an hour or two during a single visit. Since 1954, Odonata were recorded on 609 dates at Beaver Dam, ranging from late April through mid-November. The site was visited in 12 different years before 1980. When parsed into five-year intervals starting in 1955, there was no interval before 1980 when the site was visited more than seven times. All but two intervals since 1980 have more than fifty visits with a maximum of 239 between 2005 and 2009 (Table 1). While fewer surveys were conducted near the beginning and end of the flying season, over the years the site was visited at least 10 times in every monthly quarter from the fourth quarter of May through the fourth quarter of October, with more than 30 visits every quarter in July and August (Table 2).

Over 90% of all surveys at Beaver Dam were by C.N. Shiffer. Being familiar with the site, its microhabitats, and the Odonata fauna enabled him to conduct thorough surveys during the flight season and recognize unexpected species when they appeared. Thus, we have a fairly complete knowledge of the resident species and their relative

abundances. Although H.B. White visited the site once in 2013 and again in 2014, regular monitoring of Beaver Dam meadow and associated wetlands concluded on 30 June 2011.

All records used to construct Tables 1 and 2 come from a Pennsylvania Odonata log book maintained by C.N. Shiffer that was scanned and is available on-line through the Frost Museum Website (Shiffer, White, and Deans, 2014). Voucher specimens exist for virtually every species reported and are currently part of the Florida State Collection of Arthropods in Gainesville, Florida, where CNS's collection now resides.

### Seasonal and Yearly Distribution of Odonata at Beaver Dam

Table 1 shows the years in which each of the Odonata species was observed at Beaver Dam since 1982. Table 2 shows the seasonal distributions of species observed at Beaver Dam since 1954. Figure 3 graphs the species accumulation curve by plotting the cumulative number of Odonata species documented as a function of years of observation. The graph starts in 1982, the first year CNS began conducting



Figure 1. Beaver Dam meadow and Shaver Creek. Shaver Creek, a stream about two meters wide (1A, upper left), winds through the meadow with several significant spring runs and seepages (1B, upper right) contributing to its flow. The eastern end is a damp marshy fen with tall grass; other areas have bog-like character with sphagnum and cranberries. Immediately upstream of the dam is a small pool representing the lingering remnant of the former pond (1C, lower left). Above and below the meadow, Shaver Creek is a typical cold water Appalachian stream tumbling over rocks and enclosed by forest. Shaver Creek immediately below Beaver Dam is shown in 1D (lower right). A, B, and D by James White, 18 July 2014. C by Betsy Leppo, 9 October 2006.

routine surveys at the site. CNS documented 41 species at the site by the end the first year. The cumulative number of species increased steadily for the first five years; the site list gained 27 species by 1986 for a total of 68 species. In the next 25 years, species were slowly but steadily added; eventually 30 more species were added to the site list for a site total of 98 species. Orange Bluet (*Enallagma signatum*) was detected at the site in 1961 but was not seen again. Including the Orange Bluet, the site total reaches 99 species.

The fact that new species continued to be added over the next 25 years likely reflects in part the gradual change of the Beaver Dam site from an impoundment to an emergent marsh to an herbaceous shrub marsh. As the wetland vegetation matured and the percent cover of shrubs and trees increased, the site became more or less suitable for different species of Odonata. In the 1950s and 1960s, the collection of typical pond species during a few sporadic visits contrasts with the absence or near absence of those same species in recent decades when the site has been closely monitored. For example, American and Racket-tailed Emeralds (*Cordulia shurtleffii* and *Dorocordulia libera*), Chalk-fronted Corporal (*Ladona julia*), and Frosted and Dot-tailed Whiteface (*Leucorrhinia frigida* and *L. intacta*) were common or even abundant, but since 1982 their presence has been rare and sporadic. The Beaverpond Clubtail (*Gomphus borealis*), which occurred regularly at Beaver Dam in earlier

years, has not been seen there since 1999 despite intensive surveys. Similarly, spreadwings (*Lestes* spp.) have become much less common.

Not all of the Odonata faunal changes are due to the successional changes in the habitat. With changing climatic conditions, we also expect to see species with more southerly ranges moving north into Pennsylvania and colonizing sites such as Beaver Dam. Several species that have shown up in recent years appear to be expanding their ranges northward and have appeared at other sites in Central Pennsylvania (Shiffer and White, 2014; Shiffer, Leppo, and White, 2014). These include Yellow-sided, Spangled, and Slaty Skimmers (*Libellula flavida*, *L. cyanea*, and *L. incesta*), Great Spreadwing (*Archilestes grandis*), Turquoise Bluet (*Enallagma divagans*), and Double-striped Bluet (*E. basidens*). Another species that appears to have expanded its range from the north is the White-faced Meadowhawk (*Sympetrum obtrusum*).

By far the most notable colonization observed was the River Bluet (*Enallagma anna*), a species that had never before been recorded from Pennsylvania (White, 2006). It was first seen by C.N. Shiffer on 29 June 2006, when at least 10 individuals were present. Frequent surveys encountered multiple individuals through the end of July. The following two years, a small population persisted with multiple obser-

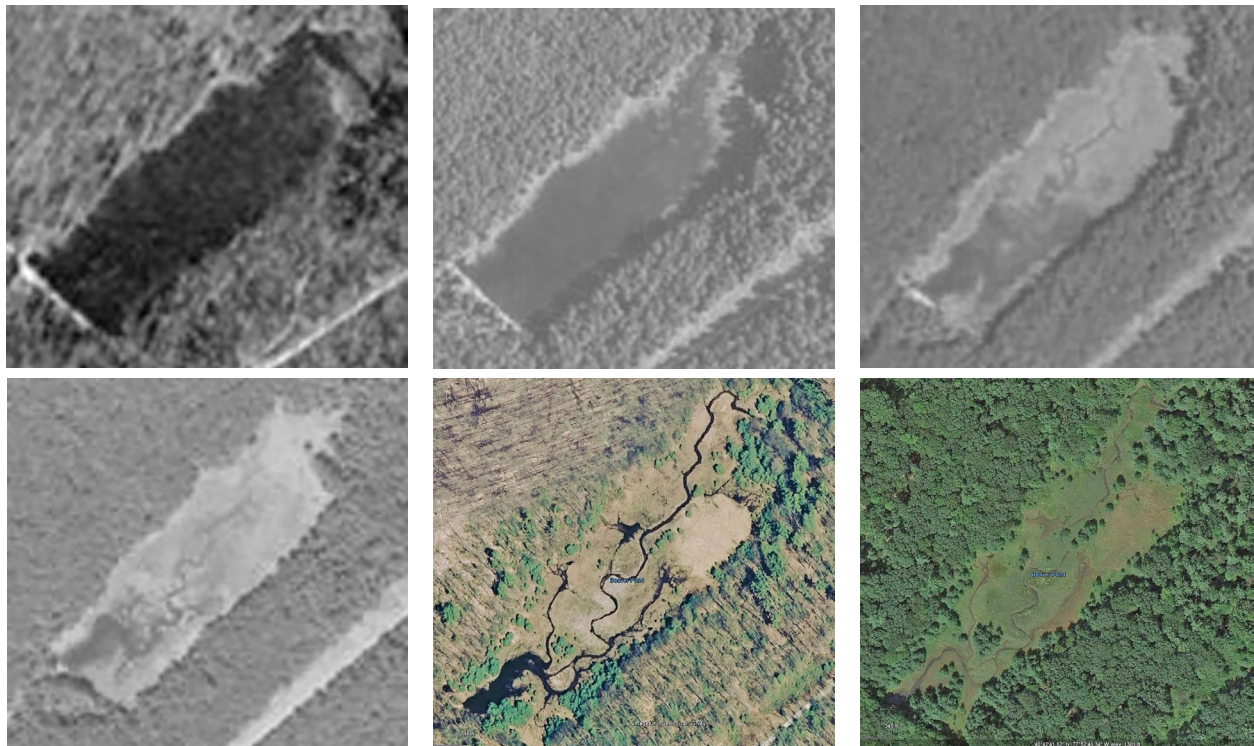


Figure 2. A succession of aerial photographs from 1938 to 2012 showing the transition of Beaver Dam from a pond to a large wet meadow with numerous seeps feeding Shaver Creek. Top left: 10 November 1938; top middle: 2 July 1957; top right: 12 August 1967; bottom left: 3 July 1971; bottom middle: 30 March 2007; bottom right: 30 August 2012. Images from USDA and Google Earth.



variations between 12 June and 17 July 2007 and between 7 June and 12 July 2008. While the species was found in 2009, 2010, and 2011, the frequency of observation and numbers observed were low. *E. anna* was not seen by H.B. White on his visits to the site on 4 July 2013 and 18 July 2014. The current status of the population is unknown and it may no longer be present.

A number of species recorded for Beaver Dam are associated with Shaver Creek and seeps that surround the area. They are probably present every year but are harder to find along the woodland stream or in forest vegetation. These include the Gray Petaltail (*Tachopteryx thoreyi*), Springtime Darner (*Basiaeschna janata*), Tiger and Twin-spotted Spiketails (*Cordulegaster erronea* and *C. maculata*), Southern and Northern Pygmy Clubtails (*Lanthus vernalis* and *L. parvulus*), and Uhler's Sundragon (*Helocordulia uhleri*). Other stream species are found along Shaver Creek in the open meadow. These include Delta-spotted Spiketail (*Cordulegaster diastatops*), Lancet, Ashy, and Sable Clubtails (*Gomphus exilis*, *G. lividus*, and *G. rogersi*), and Ski-tailed Emerald (*Somatochlora elongata*). In the bog and fen portions of the meadow, one can find Four-spotted and Painted Skimmers (*Libellula quadrimaculata* and *L. semifasciata*), Clamp-tipped and Brush-tipped Emeralds (*Somatochlora tenebrosa* and *S. walshii*), Hudsonian Whiteface (*Leucorrhinia hudsonica*), Eastern Red Damselfly (*Amphiagrion saucium*), Aurora Damselfly (*Chromagrion conditum*), Hagen's Bluet (*Enallagma hageni*), and Sphagnum Sprite (*Nehalennia gracilis*).

### Species of Concern

Twenty-two species of concern in Pennsylvania are known from the Beaver Dam site (Table 4). Of those, 11 appear to occur regularly and were documented in at least 10 out of 30 survey years. These 11 species were further examined for trends in how frequently they were observed between 1982 and 2011, when regular surveys were taking place. This 30 year period was divided into six 5-year intervals (1982–1986, 1987–1991, 1992–1996, 1997–2001, 2002–2006, and 2007–2011). The number of surveys in which a species was observed during each 5-year period was divided by the total number of surveys in that same 5-year period to account for survey effort. The percentage of positive surveys for a species within each 5-year intervals was plotted. A trend line was added to evaluate the linear trend. Species with a linear regression  $R^2$  value equal to or greater than 0.20 were considered to be increasing or decreasing (depending on the direction of the trend) at Beaver Dam;  $R^2$  values less than 0.20 were considered stable. The results of this analysis are presented in Table 4.

Species of concern that appear to be increasing at the site

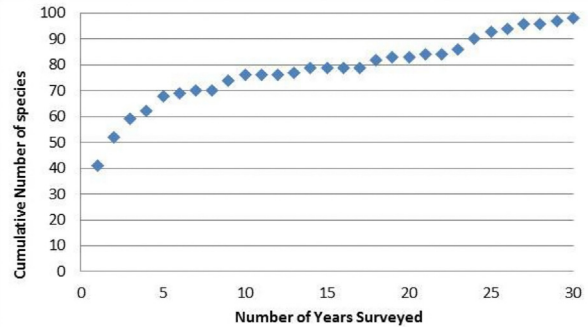


Figure 3. Graph of the cumulative number of Odonata species observed at Beaver Dam over the thirty-year period, 1982–2011.

include Turquoise Bluet (*Enallagma divagans*) and Ski-tailed Emerald (*Somatochlora elongata*). Species of concern that appear to be declining at the site include American Emerald (*Cordulia shurtleffii*), Beaverpond Clubtail (*Gomphus borealis*), Amber-winged Spreadwing (*Lestes eurinus*), and Brush-tipped Emerald (*Somatochlora walshii*). These trends may be due in part to habitat succession or a changing climate creating more or less favorable conditions for these species. Other factors that could be involved include species relationships (e.g., competition and predation), diseases, and changes in water quality.

In summary, Beaver Dam meadow and associated wetlands support a diverse and interesting Odonata fauna. Future monitoring efforts that include measures of habitat and environmental conditions shed more light on how and why the Odonata fauna is changing at Beaver Dam.

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Table 1. Yearly distribution of Odonata at Beaver Dam, Huntingdon County, Pennsylvania, 1982–2011. Numbers in the final column also include data from 1954–1982.

Year	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	Tot
<i>Calopteryx maculata</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	33	
<i>Archilestes grandis</i>																			X	X	X	X	X	X	X	X	X	X	X	12	
<i>Lestes australis</i>																				X	X	X								3	
<i>Lestes congener</i>	X		X		X													X	X	X	X	X		X	X	X	X	X		13	
<i>Lestes dryas</i>									X		X											X						X		4	
<i>Lestes eurinus</i>	X	X	X	X		X	X	X		X	X	X	X					X								X	X			14	
<i>Lestes forcipatus</i>	X	X		X	X	X			X	X	X	X					X				X		X	X	X	X	X	X		17	
<i>Lestes rectangularis</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	30	
<i>Lestes vigilax</i>	X	X	X	X	X					X															X	X				8	
<i>Amphiagrion saucium</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X					X	X	X	X	X	X	X	X	X	X	X	27	
<i>Argia apicalis</i>																						X								1	
<i>Argia fumipennis violacea</i>	X	X	X	X	X		X		X	X	X	X	X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	26	
<i>Argia moesta</i>		X								X	X										X				X	X		X		7	
<i>Chromagrion conditum</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	30	
<i>Enallagma anna</i>																										X	X	X	X	6	
<i>Enallagma annexum</i>																												X		1	
<i>Enallagma antennatum</i>																											X			1	
<i>Enallagma aspersum</i>	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	29	
<i>Enallagma basidens</i>																									X			X		2	
<i>Enallagma civile</i>																		X	X	X	X	X	X	X	X	X	X	X	X	15	
<i>Enallagma divagans</i>																	X	X	X		X		X	X	X	X	X	X	X	10	
<i>Enallagma exsulans</i>			X		X	X			X	X	X				X				X	X	X	X	X	X	X	X	X	X		15	
<i>Enallagma hageni</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	31	
<i>Enallagma signatum</i> <sup>1</sup>																														1	
<i>Ischnura hastata</i>	X																		X			X	X	X		X	X		7		

<sup>1</sup>*Enallagma signatum* was observed in 1961 but not subsequently.

Table 1, continued. Yearly distribution of Odonata at Beaver Dam, Huntingdon County, Pennsylvania

Year	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	Tot
<i>Ischnura posita</i>		X		X	X	X	X		X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	23	
<i>Ischnura verticalis</i>	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	35
<i>Nehalennia gracilis</i>		X	X	X	X	X	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	27	
<i>Nehalennia irene</i>	X	X	X	X	X	X			X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	24	
<i>Tachopteryx thoreyi</i>			X	X										X	X			X	X	X	X	X	X	X	X	X	X	X	X	16	
<i>Aeshna canadensis</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	26	
<i>Aeshna constricta</i>																										X				1	
<i>Aeshna tuberculifera</i>	X	X		X	X	X	X		X		X	X	X			X	X	X	X	X	X	X	X	X	X	X		X		22	
<i>Aeshna umbrosa</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	29	
<i>Aeshna verticalis</i>		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	30	
<i>Anax junius</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	35	
<i>Anax longipes</i>				X																										2	
<i>Basiaeschna janata</i>	X												X			X	X								X	X	X		7		
<i>Boyeria grafiana</i>	X	X	X	X				X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	22	
<i>Boyeria vinosa</i>	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	25	
<i>Epiaeschna heros</i>						X	X	X	X							X	X			X	X	X	X	X	X	X	X	X	X	13	
<i>Gomphaeschna furcellata</i>																											X			1	
<i>Rhionaeschna mutata</i>								X																						2	
<i>Arigomphus villosipes</i>	X	X		X	X			X	X	X	X				X	X									X	X				15	
<i>Dromogomphus spinosus</i>				X																					X					2	
<i>Gomphus borealis</i>		X	X	X	X	X	X	X	X	X	X	X	X	X		X														15	
<i>Gomphus exilis</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	26	
<i>Gomphus lividus</i>	X	X	X	X	X	X	X		X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	24	
<i>Gomphus rogersi</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	26	
<i>Hagenius brevistylus</i>				X	X			X	X			X	X			X	X	X	X	X	X	X	X			X	X			13	
<i>Lanthus parvulus</i>				X	X	X	X					X																		5	
<i>Lanthus vernalis</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	24	
<i>Ophiogomphus mainensis</i>			X		X	X																								3	
<i>Ophiogomphus rupinsulensis</i>			X																											1	
<i>Stylogomphus albistylus</i>	X			X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	23	
<i>Cordulegaster diastatops</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	26	
<i>Cordulegaster erronea</i>	X			X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X					16	
<i>Cordulegaster maculata</i>		X	X	X	X	X		X	X	X	X				X	X		X	X	X		X	X			X	X			15	
<i>Didymops transversa</i>		X					X			X																	X			4	
<i>Macromia i. illinoensis</i>				X																										1	
<i>Cordulia shurtleffii</i>			X	X	X	X	X	X	X	X						X	X							X	X					12	
<i>Dorocordulia libera</i>		X		X													X								X					7	
<i>Epitheca canis</i>			X			X	X									X														5	
<i>Epitheca cynosura</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X			X	X	X	X	X	X	X	X	X	X	X	23	
<i>Epitheca princeps</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X			X	X	X	X	X	X	X			X		20	
<i>Helocordulia uhleri</i>		X	X	X	X	X	X	X	X	X					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	19	
<i>Somatochlora elongata</i>				X	X			X		X					X	X				X	X	X	X	X	X	X	X	X	X	12	
<i>Somatochlora linearis</i>																				X	X		X							3	
<i>Somatochlora tenebrosa</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	29	
<i>Somatochlora walshii</i>	X													X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	13	

Table 1, continued. Yearly distribution of Odonata at Beaver Dam, Huntingdon County, Pennsylvania

Year	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	Tot
<i>Celithemis elisa</i>	X	X	X	X	X	X	X		X	X	X	X	X					X	X	X	X	X	X	X	X	X	X	X	X	24	
<i>Celithemis eponina</i>									X	X									X	X				X	X	X				7	
<i>Erythemis simplicicollis</i>		X	X		X	X			X										X		X	X	X	X	X	X	X	X	X	15	
<i>Ladona julia</i>	X	X	X	X	X	X	X		X		X								X				X		X	X	X		20		
<i>Leucorrhinia frigida</i>																								X						3	
<i>Leucorrhinia hudsonica</i>	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	23	
<i>Leucorrhinia intacta</i>		X			X																					X	X	X	7		
<i>Leucorrhinia proxima</i>																											X		1		
<i>Libellula auripennis</i>									X															X		X			3		
<i>Libellula axilena</i>																							X			X	X		3		
<i>Libellula cyanea</i>									X	X	X	X	X					X	X	X	X	X	X	X	X	X	X	X	X	16	
<i>Libellula flavida</i>																									X	X	X	X	X	6	
<i>Libellula incesta</i>																								X		X	X		3		
<i>Libellula luctuosa</i>	X	X	X	X	X	X	X		X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	25	
<i>Libellula pulchella</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	30	
<i>Libellula quadrimaculata</i>		X	X	X	X	X			X	X											X	X	X	X	X	X	X	X	13		
<i>Libellula semifasciata</i>		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	28	
<i>Libellula vibrans</i>																								X	X				2		
<i>Pachydiplax longipennis</i>									X	X					X			X	X	X	X	X	X	X	X	X	X	X	14		
<i>Pantala flavescens</i>	X				X				X	X		X						X	X	X	X	X	X	X	X	X	X	X	15		
<i>Pantala hymenaea</i>			X		X	X	X			X	X	X												X	X				9		
<i>Perithemis tenera</i>																										X	X		2		
<i>Plathemis lydia</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	31	
<i>Sympetrum internum/janae</i> <sup>2</sup>											X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	14		
<i>Sympetrum obtrusum</i>												X						X	X	X	X	X	X	X	X	X	X	X	12		
<i>Sympetrum rubicundulum</i> <sup>1</sup>													X					X	X	X	X	X	X	X	X	X	X	X	13		
<i>Sympetrum semicinctorum</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	30	
<i>Sympetrum vicinum</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	29	
<i>Tramea lacerata</i>			X	X	X	X	X			X	X	X						X	X	X	X	X	X	X	X	X	X	X	23		
<b>Total Species</b>	41	46	46	47	53	49	45	35	41	52	47	46	49	41	11	22	8	58	59	55	28	56	52	52	63	62	64	70	64	62	26
<b>Total Collecting Dates</b>	9	7	12	15	24	11	14	7	5	9	9	15	13	6	1	1	1	29	33	22	4	16	33	34	44	58	60	43	48	3	609

<sup>2</sup>There is taxonomic disagreement over whether *Sympetrum janae* and *S. internum* are separate species, a single variable species, or a hybrid complex (Donnelly, 2013). Furthermore, both are close to *S. rubicundulum*. Consequently, it is likely that two species occurred at Beaver Dam before 1995, but the distinctions were not appreciated. Thus, the absence of data points before 1995 is not necessarily an indication the species was absent.

Table 2. Seasonal distribution of Odonata at Beaver Dam, Huntingdon County, Pennsylvania. Monthly quarters defined as: I = 1st–8th, II = 9th–15th, III = 16th–23rd, and IV = 24th–end of the month.

Species Name	Apr	May				June				July				August				September				October				Nov		Earliest and Latest Dates
	IV	-	=	≡	IV	-	=	≡	IV	-	=	≡	IV	-	=	≡	IV	-	=	≡	IV	-	=	≡	IV	-	=	
<i>Calopteryx maculata</i>					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X									5/27 -9/30
<i>Archilestes grandis</i>																	X	X	X	X	X	X	X	X	X	X	X	9/3-11/7
<i>Lestes australis</i>														X	X	X		X										8/8-9/9
<i>Lestes congener</i>																X	X	X	X	X	X	X	X	X	X	X	X	8/26-11/8
<i>Lestes dryas</i>									X	X	X	X	X	X														7/6-8/9
<i>Lestes eurinus</i>								X	X	X	X	X	X															6/17-7/27
<i>Lestes forcipatus</i>										X	X	X	X	X	X	X	X	X	X									7/16-9/21
<i>Lestes rectangularis</i>								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	6/27-11/8
<i>Lestes vigilax</i>									X	X	X	X				X												7/4-8/28
<i>Amphiagrion saucium</i>				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X									5/19-9/8
<i>Argia apicalis</i>									X																			6/28
<i>Argia fumipennis violacea</i>						X	X	X	X	X	X	X	X	X	X	X	X	X	X									6/15-9/22
<i>Argia moesta</i>									X	X	X	X	X															7/11-8/13
<i>Chromagrion conditum</i>			X	X	X	X	X	X	X	X	X	X	X	X	X													5/12-8/9
<i>Enallagma anna</i>					X	X	X	X	X	X	X	X																6/7-7/31
<i>Enallagma annexum</i>					X																							6/15
<i>Enallagma antennatum</i>					X	X																						6/15-6/18
<i>Enallagma aspersum</i>					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X						6/2-10/11
<i>Enallagma basidens</i>								X			X					X												6/29-9/8
<i>Enallagma civile</i>					X			X	X				X	X		X	X	X	X	X	X	X	X	X	X	X	X	6/10-11/8
<i>Enallagma divagans</i>					X	X	X	X	X	X	X	X	X	X														6/12-8/13
<i>Enallagma exsulans</i>					X	X	X	X	X	X	X	X	X															6/13-8/15
<i>Enallagma hageni</i>				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X										6/2-9/9
<i>Enallagma signatum</i>					X																							7/12
<i>Ischnura hastata</i>		X				X			X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	5/12-10/30
<i>Ischnura posita</i>		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	5/7-10/9
<i>Ischnura verticalis</i>	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	4/28-10/14
<i>Nehalennia gracilis</i>				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	6/4-9/20
<i>Nehalennia irene</i>				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X									6/13-8/29
<i>Tachopteryx thoreyi</i>				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X									6/2-8/28
<i>Aeshna canadensis</i>								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	7/13-10/6
<i>Aeshna constricta</i>											X																	8/3
<i>Aeshna tuberculifera</i>								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	7/20-10/11
<i>Aeshna umbrosa</i>							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	7/6-11/12
<i>Aeshna verticalis</i>								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	7/16-10/30

Table 2, continued. Seasonal distribution of Odonata at Beaver Dam, Huntingdon County, Pennsylvania.

Species Name	Apr	May				June				July				August				September				October				Nov		Earliest and Latest Dates
	IV	-	=	III	IV	-	=	III	IV	-	=	III	IV	-	=	III	IV	-	=	III	IV	-	=	III	IV	-	=	
<i>Anax junius</i>		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	5/3-11/9
<i>Anax longipes</i>					X							X																5/27-7/16
<i>Basiaeschna janata</i>				X	X	X	X	X			X																	5/21-7/16
<i>Boyeria grafiana</i>											X	X	X	X	X	X	X	X	X	X								7/21-9/27
<i>Boyeria vinosa</i>											X	X	X	X	X	X	X	X	X	X	X							7/21-10/3
<i>Epiaeschna heros</i>				X	X	X	X	X	X	X	X	X	X	X	X	X												5/21-9/2
<i>Gomphaeschna furcellata</i>					X																							6/4
<i>Rhionaeschna mutata</i>							X																					6/17-6/20
<i>Argomphus villosipes</i>					X	X	X	X	X	X																		6/4-7/17
<i>Dromogomphus spinosus</i>									X																			7/3-7/7
<i>Gomphus borealis</i>					X	X	X	X	X	X	X																	5/27-7/19
<i>Gomphus exilis</i>					X	X	X	X	X	X	X	X																5/27-7/30
<i>Gomphus lividus</i>					X	X	X	X	X	X	X	X																5/24-7/16
<i>Gomphus rogersi</i>					X	X	X	X	X	X	X	X	X	X														6/1-8/13
<i>Hagenius brevistylus</i>							X	X	X	X																		6/17-7/18
<i>Lanthus parvulus</i>					X	X	X	X	X																			5/28-7/8
<i>Lanthus vemalis</i>					X	X	X	X	X	X	X	X																5/24-7/30
<i>Ophiogomphus mainensis</i>					X																							6/3-6/6
<i>Ophiogomphus rupinsulensis</i>					X	X																						6/4-6/21
<i>Stylogomphus albistylus</i>						X	X		X	X	X	X	X	X	X													6/10-8/26
<i>Cordulegaster diastatops</i>					X	X	X	X	X	X	X	X																5/19-7/31
<i>Cordulegaster erronea</i>								X	X	X	X	X	X	X	X	X	X											6/30-9/10
<i>Cordulegaster maculata</i>					X	X	X	X	X		X																	5/31-7/30
<i>Didymops transversa</i>					X	X																						5/22-6/12
<i>Macromia l. illinoiensis</i>									X																			7/1
<i>Cordulia shurtleffii</i>					X	X	X	X	X	X	X																	5/24-7/19
<i>Dorocordulia libera</i>					X	X	X	X	X	X																		6/1-7/12 1
<i>Epithea canis</i>					X	X																						5/27-6/2
<i>Epithea cynosura</i>					X	X	X	X	X	X	X	X																5/27-7/24
<i>Epithea princeps</i>					X	X	X	X	X	X	X	X	X															6/6-8/8
<i>Helocordulia uhleri</i>					X	X	X	X	X	X	X	X																5/21-7/29
<i>Somatochlora elongata</i>										X	X	X	X	X	X	X												7/12-9/6 1
<i>Somatochlora linearis</i>														X	X		X											8/23-9/17
<i>Somatochlora tenebrosa</i>						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X							6/22-10/8 2
<i>Somatochlora walshii</i>						X	X	X	X	X	X	X	X	X	X	X												6/17-9/10
<i>Celithemis elisa</i>					X	X	X	X	X	X	X	X	X	X														6/8-8/18
<i>Celithemis eponina</i>									X	X	X	X	X	X	X	X	X					X						7/3-10/4
<i>Erythemis simplicicollis</i>						X	X	X	X	X	X	X	X	X	X	X	X											6/10-9/21
<i>Ladona julia</i>					X	X	X	X	X	X	X	X																6/3-7/24
<i>Leucorrhinia frigida</i>					X	X			X		X																	6/2-8/3
<i>Leucorrhinia hudsonica</i>					X	X	X	X	X	X	X	X																5/27-7/27
<i>Leucorrhinia intacta</i>					X	X	X		X	X	X	X																6/3-7/16
<i>Leucorrhinia proxima</i>						X																						6/22

Table 2, continued. Seasonal distribution of Odonata at Beaver Dam, Huntingdon County, Pennsylvania.

Species Name	Apr		May				June				July				August				September				October				Nov		Earliest and Latest Dates				
	IV	-	II	III	IV	-	II	III	IV	-	II	III	IV	-	II	III	IV	-	II	III	IV	-	II	III	IV	-	II						
<i>Libellula auripennis</i>						X	X	X		X	X																		6/7-7/15				
<i>Libellula axilena</i>								X	X	X	X																		6/18-7/15				
<i>Libellula cyanea</i>								X	X	X	X	X	X	X	X	X													6/4-8/17				
<i>Libellula flavida</i>						X	X	X	X	X	X	X	X	X	X	X													7/7-8/21				
<i>Libellula incesa</i>										X							X												7/7-9/1				
<i>Libellula luctuosa</i>							X	X	X	X	X	X	X	X	X	X		X											6/10-9/10				
<i>Libellula pulchella</i>					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								5/28-10/8				
<i>Libellula quadrimaculata</i>					X	X	X	X	X	X			X																5/27-7/28				
<i>Libellula semifasciata</i>				X	X	X	X	X	X	X	X	X	X	X	X	X													5/13-8/24				
<i>Libellula vibrans</i>										X	X																		7/6-7/10				
<i>Pachydiplax longipennis</i>					X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	5/26-10/18				
<i>Pantala flavescens</i>									X	X	X	X	X		X	X	X	X	X	X						X			6/25-10/21				
<i>Pantala hymenaea</i>									X	X	X	X	X	X	X	X				X	X								6/27-10/8				
<i>Plathemis lydia</i>					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X									5/27-9/22				
<i>Perithemis tenera</i>											X						X												7/16-9/1				
<i>Sympetrum internum/janeae</i>							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	6/15-10/20				
<i>Sympetrum obtrusum</i>											X	X	X		X	X	X	X	X	X	X	X	X						7/12-10/12				
<i>Sympetrum rubicundulum</i>										X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	6/29-10/31				
<i>Sympetrum semicinctum</i>										X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	6/29-10/11				
<i>Sympetrum vicinum</i>																X	X	X	X	X	X	X	X	X	X	X	X	X	8/19-11/12				
<i>Tramea lacerata</i>							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	6/13-10/23				
Total Species by Quarter	1	3	4	9	26	43	50	58	58	67	64	66	64	31	49	49	48	41	35	41	35	27	41	31	28	21	24	16	12	11	6	6	4/28-11/12
Number of visits per quarter 1954-2011	1	2	1	2	11	20	14	28	24	38	30	35	44	31	38	35	35	35	27	41	31	28	21	37	19	14	10	10	6	3			

### Photo Submissions for ARGIA

If you would like to contribute a photo as a possible front or back cover “glamour shot” for ARGIA, please contact the Editor at <celeste@xerces.org>. We need high-quality images in TIFF or JPEG format with a resolution of 300 ppi at about 6.5 inches in width; please check the resolution before sending. Photos that lack sufficient resolution to be reproduced at the larger cover size but show an interesting behavior or specimen may be suitable for Parting Shots if they have a resolution of 300 ppi at column width (3.2 inches).

Photos can be sent as e-mail attachments (up to 15 Mb), via a file transfer service, or in GoogleDrive. **Please do not send photos embedded in the text of an e-mail!** Submitted photos may be saved for later issues, but they will never be used for other purposes than ARGIA or sent to other individuals to use. Please include metadata, including date and location (state and county at minimum) for each photograph.

Table 3. Complete List of Beaver Dam Odonata

*Calopteryx maculata* (Ebony Jewelwing)  
*Archilestes grandis* (Great Spreadwing)  
*Lestes australis* (Southern Spreadwing)  
*L. congener* (Spotted Spreadwing)  
*L. dryas* (Emerald Spreadwing)  
*L. eurinus* (Amber-winged Spreadwing)  
*L. forcipatus* (Sweetflag Spreadwing)  
*L. rectangularis* (Slender Spreadwing)  
*L. vigilax* (Swamp Spreadwing)  
*Amphiagrion saucium* (Eastern Red Damsel)  
*Argia apicalis* (Blue-fronted Dancer)  
*A. fumipennis violacea* (Variable Dancer)  
*A. moesta* (Powdered Dancer)  
*Chromagrion conditum* (Aurora Damsel)  
*Enallagma anna* (River Bluet)  
*E. annexum* (Northern Bluet)  
*E. antennatum* (Rainbow Bluet)  
*E. aspersum* (Azure Bluet)  
*E. basidens* (Double-striped Bluet)  
*E. civile* (Familiar Bluet)  
*E. divagans* (Turquoise Bluet)  
*E. exsulans* (Stream Bluet)  
*E. hageni* (Hagen's Bluet)  
*E. signatum* (Orange Bluet)  
*Ischnura bastata* (Citrine Forktail)  
*I. posita* (Fragile Forktail)  
*I. verticalis* (Eastern Forktail)  
*Nehalennia gracilis* (Sphagnum Sprite)  
*N. irene* (Sedge Sprite)  
*Tachopteryx thoreyi* (Gray Petaltail)  
*Aeshna canadensis* (Canada Darner)  
*A. constricta* (Lance-tipped Darner)  
*A. tuberculifera* (Black-tipped Darner)  
*A. umbrosa* (Shadow Darner)  
*A. verticalis* (Green-striped Darner)  
*Anax junius* (Common Green Darner)  
*A. longipes* (Comet Darner)  
*Basiaeschna janata* (Springtime Darner)  
*Boyeria grafiana* (Ocellated Darner)  
*B. vinosa* (Fawn Darner)  
*Epiaeschna heros* (Swamp Darner)  
*Gomphaeschna furellata* (Harlequin Darner)  
*Rhionaeschna mutata* (Spatterdock Darner)  
*Arigomphus villosipes* (Unicorn Clubtail)  
*Dromogomphus spinosus* (Black-shouldered Spinyleg)  
*Gomphus borealis* (Beaverpond Clubtail)  
*G. exilis* (Lancet Clubtail)  
*G. lividus* (Ashy Clubtail)  
*G. rogersi* (Sable Clubtail)

*Hagenius brevistylus* (Dragonhunter)  
*Lanthus parvulus* (Northern Pygmy Clubtail)  
*L. vernalis* (Southern Pygmy Clubtail)  
*Ophiogomphus mainensis* (Maine Snaketail)  
*O. rupinsulensis* (Rusty Snaketail)  
*Stylogomphus albistylus* (Least Clubtail)  
*Cordulegaster diastatops* (Delta-spotted Spiketail)  
*C. erronea* (Tiger Spiketail)  
*C. maculata* (Twin-spotted Spiketail)  
*Didymops transversa* (Stream Cruiser)  
*Macromia illinoiensis illinoiensis* (Illinois River Cruiser)  
*Cordulia shurtleffi* (American Emerald)  
*Dorocordulia libera* (Racket-tailed Emerald)  
*Epithecica canis* (Beaverpond Baskettail)  
*E. cynosura* (Common Baskettail)  
*E. princeps* (Prince Baskettail)  
*Helocordulia uhleri* (Uhler's Sundragon)  
*Somatochlora elongata* (Ski-tailed Emerald)  
*S. linearis* (Mocha Emerald)  
*S. tenebrosa* (Clamp-tipped Emerald)  
*S. walsbii* (Brush-tipped Emerald)  
*Celithemis elisa* (Calico Pennant)  
*C. eponina* (Halloween Pennant)  
*Erythemis simplicicollis* (Eastern Pondhawk)  
*Ladona julia* (Chalk-fronted Corporal)  
*Leucorrhinia frigida* (Frosted Whiteface)  
*L. hudsonica* (Hudsonian Whiteface)  
*L. intacta* (Dot-tailed Whiteface)  
*L. proxima* (Red-waisted Whiteface)  
*Libellula auripennis* (Golden-winged Skimmer)  
*L. axilena* (Bar-winged Skimmer)  
*L. cyanea* (Spangled Skimmer)  
*L. flavida* (Yellow-sided Skimmer)  
*L. incesta* (Slaty Skimmer)  
*L. luctuosa* (Widow Skimmer)  
*L. pulchella* (Twelve-spotted Skimmer)  
*L. quadrimaculata* (Four-spotted Skimmer)  
*L. semifasciata* (Painted Skimmer)  
*L. vibrans* (Great Blue Skimmer)  
*Pachydiplax longipennis* (Blue Dasher)  
*Pantala flavescens* (Wandering Glider)  
*P. hymenaea* (Spot-winged Glider)  
*Perithemis tenera* (Eastern Amberwing)  
*Platbemis lydia* (Common Whitetail)  
*Sympetrum internum/janae*<sup>1</sup> (Cherry-faced/Jane's Meadowhawk)  
*S. obtrusum* (White-faced Meadowhawk)  
*S. rubicundulum* (Ruby Meadowhawk)  
*S. semicinctum* (Band-winged Meadowhawk)  
*S. vicinum* (Autumn Meadowhawk)  
*Tramea lacerata* (Black Saddlebags)

<sup>1</sup>There is taxonomic disagreement over whether *Sympetrum janae* and *S. internum* are separate species, a single variable species, or a hybrid complex (Donnelly, 2013). It is likely that two species occurred at Beaver Dam before 1995, but the distinctions were not appreciated. Thus, the absence of data points before 1995 is not necessarily an indication the species was absent.



Table 4. Odonata Species of Greatest Conservation Need (SGCN) in Pennsylvania documented at Beaver Dam. Population trends were analyzed for eleven species that were observed in at least 10 of the 30 years between 1982 and 2011. During this period 587 surveys were conducted. Species of concern and global/state ranks are based on the invertebrate assessment for Pennsylvania's 2015 State Wildlife Action Plan (Leppo et al., 2015). State rankings range from S1, highest conservation concern, to S5, least conservation concern. Global rank definitions are available on the NatureServe web site at <<http://explorer.natureserve.org/granks.htm>>; state (subnational) rank definitions are available at <<http://explorer.natureserve.org/nsranks.htm>>.

Scientific Name	Global / State Rank	Total # years	Total # surveys	Trend	R <sup>2</sup>
<i>Lestes dryas</i>	G5 / S3	4	6		
<i>Lestes eurinus</i>	G4 / S3S4	14	31	Decreasing	0.38
<i>Enallagma anna</i>	G5 / S1S2	6	48		
<i>Enallagma divagans</i>	G5 / S3S4	10	56	Increasing	0.85
<i>Tachopteryx thoreyi</i>	G4 / S3	16	85	Stable	0.01
<i>Aeshna constricta</i>	G5 / S3S4	1	1		
<i>Anax longipes</i>	G5 / S2S3	1	1		
<i>Gomphaeschna furcillata</i>	G5 / S3	1	1		
<i>Rhionaeschna mutata</i>	G4 / S3	1	1		
<i>Gomphus borealis</i>	G4 / S3	13	35	Decreasing	0.72
<i>Gomphus rogersi</i>	G4 / S3	26	135	Stable	0.14
<i>Ophiogomphus mainensis</i>	G4 / S3S4	3	3		
<i>Cordulegaster erronea</i>	G4 / S3	16	61	Stable	0
<i>Cordulia shurtleffii</i>	G5 / S3S4	10	21	Decreasing	0.55
<i>Helocordulia uhleri</i>	G5 / S3S4	19	68	Stable	0.07
<i>Somatochlora elongata</i>	G5 / S3	12	41	Increasing	0.46
<i>Somatochlora linearis</i>	G5 / S2S3	3	3		
<i>Somatochlora walshii</i>	G5 / S3	13	110	Decreasing	0.93
<i>Leucorrhinia proxima</i>	G5 / S2S3	1	1		
<i>Libellula auripennis</i>	G5 / S2S3	3	5		
<i>Libellula axilena</i>	G5 / S1S2	3	5		
<i>Sympetrum semicinctum</i>	G5 / S3S4	29	351	Stable	0

### Request for South American *Orthemis* and North American *Dythemis* Specimens

I am looking for specimens of *Orthemis levis* from South America for DNA studies, as well as *Orthemis schmidti* specimens from Honduras and Nicaragua. I am also looking for specimens of *Dythemis maya* from North America for DNA studies. If you have any specimens I could borrow, I would appreciate it. Let me know if you have any questions. Thank you very much!

Jerrell Daigle <[jdaigle@netally.com](mailto:jdaigle@netally.com)>

# Nematode Parasites in Nymphs of *Macromia illinoensis* (Swift River Cruiser) in Northern Wisconsin Lakes

Ken Tennessen <ktennessen@centurytel.net>, William Smith, Marla Garrison, and Denny Johnson

With the waves of a northern Wisconsin lake lapping at the top of their chest waders, KT and WS were looking for the evasive nymph of *Somatochlora cingulata* (Selys), the Lake Emerald, in the summer of 2013. There was a record of this species from Lynx Lake, which is north of Boulder Junction in Vilas County, so the search for the microhabitat was on. Along the north shore (Fig. 1), we rejoiced in finding a few big *S. cingulata* nymphs (a story for another time), but among the other dragonfly species we dredged up were a number of nymphs of *Macromia illinoensis* Walsh (Swift River Cruiser) that appeared to have something inside them. When we turned the sprawling, long-legged nymphs over, we could see through the nearly transparent cuticle what looked like white coils (Fig. 2); these surely did not appear to be a normal part of the digestive system. With a hand lens, we estimated that at least half of the two dozen or more nymphs we cursorily examined had these forms.



Figure 1. Sampling site on north shore of Lynx Lake, Vilas County, Wisconsin. Photo by Marla Garrison.

With the suspicion that the white coils were some sort of parasitic worm, we decided that an in-depth survey of northern lakes was warranted and invited MG and DJ to join us in this effort for 2014. With a team now formed, the “Overloaded Odonate Parasite Study” (OOPS) could commence. So we selected seven large lakes that we suspected had moderate to strong wave action and mixed gravel/sand substrates (in other words, likely spots for *M. illinoensis*), in Vilas and Forest counties. We made intensive collections of *M. illinoensis* and also *Didymops transversa* (Say) (Stream Cruiser), as 2013 samples of the latter species from Lynx Lake showed it likely to have the white worms also. Nymphs were preserved in 80% ethanol and then dissected to verify the presence of parasites.

Of the two macromiid species, *M. illinoensis* was more common in all lakes sampled except for Jute Lake, where it was apparently absent. Small lakes with sand-dominated substrate and mild wave action, such as Jute Lake, do not appear to provide adequate habitat for *M. illinoensis*. In total, we examined over 700 nymphs. Dissections completed thus far show that parasitized nymphs were found in five of the seven lakes (Table 1). Only one of the seven,

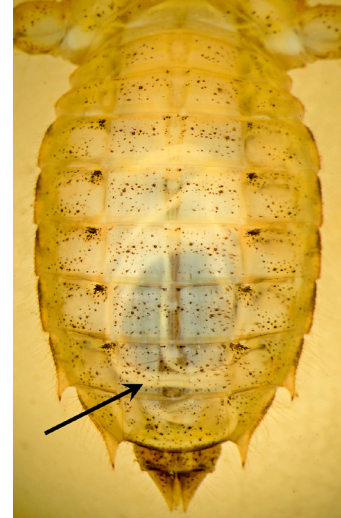


Figure 2. Nymph of *Macromia illinoensis*, ventral view. Arrow indicates internal worms.

Lynx Lake, which we sampled twice, had high infection rates. In Black Oak, Franklin, Jute and Tomahawk lakes, infection rates were zero or very low (<6%); although we have not yet completed dissection of samples from Clear and Sparkling lakes, data so far indicates their rates are also very low. Over many years of sampling *M. illinoensis* nymphs in Wisconsin rivers, we do not remember seeing any nymphs containing nematodes.

A high rate of infection (ca 90%) was found in both species in Lynx Lake early in the summer of 2014, but a much lower percentage (25%) was found three months later, in mid-September. We suspect that this reduced rate of infection in early fall, if verified by future sampling, might somehow be tied to the parasite’s life cycle. We sent a sample of the worms to Dr. Tesfamariam Mengistu, a nematologist at the University of Florida, who confirmed that they are nematodes and that they appear to belong to the family

Table 1. Percentage of nymphs of *Macromia illinoensis* and *Didymops transversa* positive for nematode parasites in seven northern Wisconsin lakes in 2014. dnf: dissection not finished; neg: species not found; N: total # of macromiid nymphs examined. <sup>1</sup> 18 June 2014; <sup>2</sup> 19 September 2014.

	Black Oak	Clear	Franklin	Jute	Lynx <sup>1</sup>	Lynx <sup>2</sup>	Sparkling	Tomahawk
M. ill.	1.1%	dnf	5.2%	neg.	91.2%	22.2%	dnf	0.9%
D. trans.	0%	dnf	0%	4.7%	85.7%	25.0%	dnf	0%
N	100	141	122	43	55	49	78	114



Figure 3 (Left). Nymph of *Macromia illinoensis*, ventral view, with sternites removed, exposing nematode worms inside. Stacked image, by Denny Johnson. Figure 4 (Right). Nematode removed from abdomen of *M. illinoensis*. Photo by Marla Garrison.

Mermithidae; however, the exact identity of these worms is as yet uncertain.

Our results show that the worms usually occupy a large portion of the abdomen (Fig. 3). Some of the nymphs had as many as four or more nematodes in the body cavity. The worms were long and coiled (Fig. 4), extending through much of the abdomen and sometimes into the thoracic cavity. The worms, when uncoiled, had a maximum length of

ca 13.5 cm! In some of the infected nymphs the fat body was much reduced, but because of variation in uninfected nymphs, we are not sure what effect the worms might have on the nymphs' internal organs. But from our immediate subjective viewpoint, this parasitic load seemed intolerable. We kept four full-grown nymphs alive from the Franklin Lake (Forest County) sample and put them in a small aquarium; within a few days after capture, the nymphs died and long, white nematodes were writhing in the bottom sand. This small sample (taken 16 July) indicates that the nymphs die when the nematodes exit the nymphs to complete their life cycle sometime in mid-summer.


There are few published reports of nematodes parasitizing Odonata nymphs, and we have yet to find any paper involving macromiids in a nematode life cycle. This year we plan to further our effort to determine 1) the extent of infection in macromiids in Wisconsin lakes and the variability in infection rates among lakes; 2) whether infection rates are seasonal; and 3) the effects these parasites have on macromiid nymph health and survival. We also plan to team up with a parasitologist to learn as much as possible about the life cycle of the nematode parasites. DNA analysis will probably be necessary to identify the parasite(s). Field and lab studies are being planned for 2015 and 2016. 



Figure 5. Ken, Bill and Denny enjoying a moment after a successful survey for macromiid nymphs at Lynx Lake. Photo by Marla Garrison.

## *Celithemis elisa* (Calico Pennant) Emergence Nosedives in 2014

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Our 10th annual monitoring of the emergence pattern of *Celithemis elisa* (Calico Pennant) brought an unexpected and inexplicable change. Each year since 2005 we have walked the perimeter of our pond once each morning, counting teneral and observing emergence behavior. The number of *C. elisa* that this small farm pond produces has been staggering and a joy to observe; the highest number was almost 11,000 in 2006. Thus far we have realized several consistent patterns in emergence behavior:

1. They emerge *en masse* in the first few days of their long emergence period (up to 83% of season total; table 1) then trickle off to relatively low daily numbers with a few small surges scattered throughout the season.
2. They emerge all day and all night, with the bulk appearing an hour or two after sunrise.
3. Nighttime emergence begins shortly after full darkness and continues all night long.
4. Many exhibit a preference to emerge in groups, on the same plant, rather than scattered individually around the pond, a behavior we call “clumping”.

Armed with this knowledge we entered the 2014 season expecting the same pattern, but this time they blew the key trait right out of the proverbial water.


There was NO mass emergence in the beginning of the season. Numbers for the period when the big surge should have taken place were very, very low. As shown in Table 1, only 127 were counted over a two day period of what we stretched into a “peak period”—only 5% of the season total. We expected a surge each day, but none came. No mass emergence and no big showing at all.

Compared to past years the only consistent factor covered in the table was the Total Emergence Period, which fit within average. The overall number of teneral counted was so very low as to be quite disappointing. This came as a surprise, considering the excellent year they had in 2013. A look at our weather data showed no real reason for this. We did experience a very cold winter, but the pond is quite deep with plenty of submerged aquatic vegetation, so winter mortality should not have been a factor. In past years they have emerged in heat, drought, cold, rain, wind, you name it. We had figured 10 years of observing would be enough and 2014 could be our last year, but we are perplexed. We can't let it go now.

Table 1. Summary of *Celithemis elisa* (Calico Pennant) emergence activity. Numbers derived from a single daily circumambulation of the study pond.

Year	Season Total	Peak Period	Peak Percent of Total	Total Emergence Period
2005	2,455	7-11 June	83% (2,028)	>62 Days
2006	10,944	5-9 June	47% (5,169)	63 Days
2007	6,497	1-6 June	75% (4,892)	61 Days
2008	8,237	8-12 June	76% (6,244)	64 Days
2009	1,505	6-10 June	15% (229)	68 Days
2010	642	31 May-4 June	43% (277)	82 Days
2011	1993	1-7 June	58% (1,152)	51 Days
2012	982	27-31 May	57% (556)	54 Days
2013	3975	31 May-3 June	63% (2532)	56 Days
2014	615	3-4 June	5% (127)	51Days

Past season's summaries can be found in:

- Gregoire, S. and J. Gregoire. 2007. *Celithemis elisa* (Calico Pennant) emergence period in the Fingerlakes Highlands of New York state. ARGIA 19: 10.
- Gregoire, S. and J. Gregoire. 2008. Update on *Celithemis elisa* (Calico Pennant) emergence in New York State. ARGIA 20(1) 1: 14.
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- Gregoire, S. and J. Gregoire. 2013. *Celithemis elisa* (Calico Pennant) bounces back. ARGIA 25(4): 30. 

# Observation of *Argia bipunctulata* (Seepage Dancer) in Tucker County, West Virginia

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On 25 July 2014, a single individual of *Argia bipunctulata* Hagen (Seepage Dancer) was observed flying along a slowly meandering stream in a high-elevation wetland in West Virginia (N 39°04'16.1", W 79°28'50.0"). This is the first documented and confirmed record of the species in the state of West Virginia (Sue Olcott, West Virginia Division of Natural Resources, personal communication), despite its documented occurrence in all of the states adjacent to West Virginia (Abbott, 2015). After two summers of standardized surveys at seven wetland sites carried out by the first author, this was the first and only observation of the species.

The high-elevation wetlands in Tucker County are unique ecosystems for the entire region and are characterized by




Seepage Dancer (*Argia bipunctulata*) observed in Tucker County, West Virginia.

high acidity, a cool climate and high precipitation (Gibson, 1970; Wieder 1985). These ecosystems typically contain springs, seeps, and headwater streams as sources of water. The observation occurred on a large (approx. 80.5 ha) fen on Canaan Mountain near a small stream with a muck bottom. The vegetation at the site consists predominately of bryophytes, including peat (*Sphagnum* spp. L.) and haircap (*Polytrichum* spp. Hedwig) mosses. Common emergent plants include tawny cottongrass (*Eriophorum virginicum* L.), white beak-sedge (*Rhynchospora alba* (L.) Vahl), and narrow panicle rush (*Juncus brevicaudatus* (Engelm.) Fernald). A mixed red spruce/northern hardwood forest surrounds the wetland. Other damselfly species observed at the site included *Amphiagrion saucium* Burmeister (Eastern Red Damsel), *Ischnura verticalis* Say (Eastern Forktail), *I. hastata* Say (Citrine Forktail), and *Nehalennia irene* Hagen (Sedge Sprite).

## Acknowledgements

We would like to thank the West Virginia Division of Natural Resources for providing funding to support the surveys. Appreciation is extended to Sue Olcott for verifying the identity of the photographed damselfly.

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- Gibson, J.R. 1970. The flora of Alder Run Bog, Tucker County, West Virginia. *Castanea* 35(2): 81–98.
- Wieder, K.R. 1985. Peat and water chemistry at Big Run Bog, a peatland in the Appalachian Mountains of West Virginia, USA. *Biochemistry* 1(3): 277–302. 

## DSA Buttons Still Available

I have extra buttons from previous DSA annual meetings. If you need any one of them, please let me know and I will get it to you. Thanks!

Jerrell Daigle <[jdaigle@netally.com](mailto:jdaigle@netally.com)>

## Wing Whacking

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

Dragonflies use their wings in a variety of ways and for a variety of purposes. The most obvious, of course, is as a means of locomotion. Even in flight, however, the wings can operate in a number of different ways—sometimes with the forewings and hindwings flapping in unison, sometimes with them flapping out of phase.

Dragonflies also spend a considerable fraction of their flight time gliding and soaring. On occasion they even “sky dive”, which is accomplished by holding their wings high above their body and dropping briefly in free fall (Walker, 2013a). Wings, it seems, are as flexible in their various modalities as they are in their constitution.

Other interesting uses for wings have also been observed. For example, “wing grabbing” is a behavior exhibited by some males as they attach in tandem with a female (Walker, 2013b). In addition, “spin-drying” at 1,000 rpm about an axis running along the length of the wings is a fascinating behavior that is done to dry off after a series of “splash-dunks” (Walker, 2011a, 2011b).

In this article, I report on another way that dragonflies use their wings, which I refer to as “wing whacking.” So far, this behavior has been observed in Paddle-tailed Darners (*Aeshna palmata*) and White-faced Meadowhawks (*Sympetrum obtrusum*), but it seems likely that many other species will be found to display similar behavior.

### The Basics of Wing Whacking

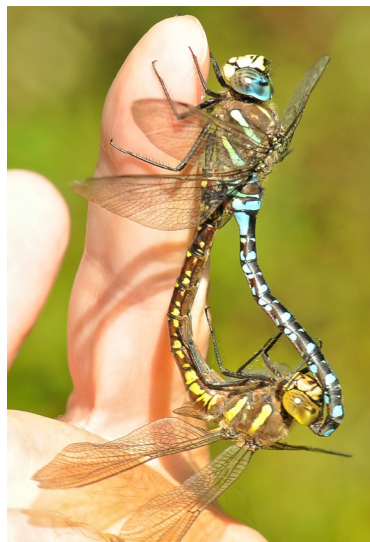


Figure 1. Paddle-tailed Darners mating in the wheel position.

Wing whacking occurs when a pair of dragonflies are actively mating in the wheel position (Figure 1). The mating process can last for several minutes, and can involve a good deal of activity. Sometimes the female appears to become a bit fidgety, and will start to move about. When this happens the male lifts his abdomen upward a bit, and then “whacks”

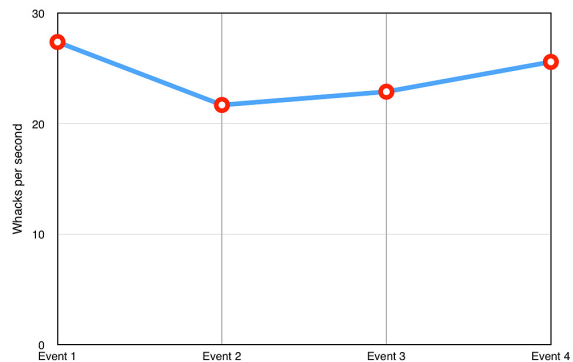


Figure 2. Frequency of wing whacking, in whacks per second, for four different events analyzed with slow-motion video.

the female on either side of her head with his wings. The result of the wing whacking is that the female settles down and mating continues.

In a typical situation, the male whacks the female 3–4 times in rapid succession for about 0.15 s, as determined by counting frames in a slow-motion video shot at 240 frames per second. The male then rests for about 0.18 s before resuming with a second burst of 3–4 whacks. Two rounds of wing whacking are sufficient to restore calm in the cases I’ve observed so far.

The frequency of wing whacks—that is, the number of whacks per second—can be determined from the slow-motion videos. I have been able to analyze four separate wing-whacking events so far, and in each case the whacking frequency has been determined (see Figure 2). Notice that the average whacking frequency is about 25 whacks per second, which is slightly slower than the typical wing beat frequency in flight of about 35 beats per second.

The same basic wing whacking behavior has been observed when a single male attempts to separate a mating pair. In this case, the interloping male approaches the pair and attempts to land on the thorax of the mating male. As it comes in for a landing, the male in the wheel position whacks the other male with its wings, just as it would do with a fidgety female. In the cases I’ve observed, the wing whacking has been effective at repelling the unwanted advances.

### Post-Whacking Quivering

An interesting and unexpected element of the wing-whacking behavior is observed after the female has settled down. It would seem that once the goal of restoring calm

has been achieved, the male would simply rest. Instead, he “quivers” his hindwings—and the hindwings only—much like the shaking motion of a quaking aspen leaf.

The quivering motion of the male’s hindwings is observed to last for about 0.25 s to 0.50 s, and is fairly rapid, clocking in at about 55 vibrations per second. The purpose of the quivering is unclear. Perhaps it serves as a signal to the female that the male is prepared to resume wing whacking if necessary.

### Questions for Future Research

Wing whacking joins the ranks of interesting wing behaviors displayed by dragonflies. It will be interesting to see what other species show a similar behavior, and how many species use a similar whacking motion to repel unwanted males.

Finally, it should be noted that to the human eye it appears the female fidgets, and that the male reacts and calms her down, as described above. Another possibility, however, is that the male is actually the one who is fidgeting as he conducts the important business of mating and sperm transfer. Perhaps the wing whacking is simply a manifestation of the male trying to retain control of the female during active mating. Additional observations should shed more light on these questions.

## An Unexpected Encounter with Elusive Clubtails (*Stylurus notatus*) in Winnebago County, Illinois

Paul Dacko <pdacko1@ameritech.net>

I got a tip from Marla Garrison in late August that Smoky Rubyspots (*Hetaerina titia*) were flying at the Pecatonica River by the Pecatonica Fairgrounds area in Pecatonica, Winnebago County, Illinois, about 90 miles from my home. So I called my friend Paul Massey, who is now an avid dragonfly enthusiast, and we selected a probable sunny day on 13 September 2014 to give it a try.

We started out around 7:30 a.m., arriving early to see if we could find anything roosting on plants, hoping to catch the rising sun as the overnight temperature was only 36°F. We parked by the tennis courts in a park next to the fairgrounds and walked toward the river where the rubyspots should be, then split up to see if we could scare up anything in the heavy brush and grasses near the river bank. After 15 minutes, something flew from the high grasses into a maple tree on the river bank edge. It flew down after some small insects, then returned to the maple tree.

### Acknowledgements

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

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Walker, J.S. 2011a. Spin-dry dragonflies. *ARGIA* 23(3): 29–31.  
Walker, J.S. 2011b. Splash-dunk analysis, 2011. *ARGIA* 23(4): 29–30.

### Online Material

Wing whacking in Paddle-tailed Darner pair: <[https://www.youtube.com/watch?v=7loR\\_1vWQGM&list=UUMwHI\\_FOla84YxH7rt66CzQ](https://www.youtube.com/watch?v=7loR_1vWQGM&list=UUMwHI_FOla84YxH7rt66CzQ)>.

Quivering motion of the hindwings of a male Paddle-tailed Darner: <[https://www.youtube.com/watch?v=eHhq-BhD4vM&list=UUMwHI\\_FOla84YxH7rt66CzQ](https://www.youtube.com/watch?v=eHhq-BhD4vM&list=UUMwHI_FOla84YxH7rt66CzQ)>.






Female (upper) and male (lower) Elusive Clubtail (*Stylurus notatus*), Pecatonica River Fairgrounds, Winnebago County, Illinois, 13 September 2014.

angles as we could until it took off over the water. We started to call the maple “the magic tree”...

We checked out the other side and did see another similar dragonfly land very briefly but it took off before we could get a good look, much less a picture. By this time it was late in the day so we decided to leave. But before we did, we wanted to try the magic tree again—and it did not disappoint. After a bit of searching with binoculars we found another female dragonfly, and took a few pictures before it took off for a much higher perch in the tree.

We were losing good light now so we headed home, speculating the entire way about what we might have found. My first thought was that it looked similar to a Midland Clubtail (*Gomphus fraternus*), but then I remembered a presentation that Cynthia McKee had given and her description of her find a year or so earlier of an Elusive Clubtail (*Stylurus notatus*). The thing I remembered was her description of its blue eyes—and our dragonfly had *very* blue eyes. I checked OdonataCentral for sightings and pictures of Elusive Clubtails, but there were very few and most pictures were of newly emerged, dull-colored individuals. I searched the internet and managed to find a few good pictures that indeed did look identical to my unknown dragonfly.

Paul Massey and I thus submitted some of our pictures to OdonataCentral, which were subsequently confirmed as Elusive Clubtail. I can not even imagine what the odds would be to find and photograph a single Elusive Clubtail, much less both a male and female at the same time! 

## Dragonflies and Damselflies of North Carolina: New Approximation Now Online

Harry LeGrand <harry.legrand@ncdenr.gov> and Tom Howard <tom.howard@ncparks.gov>

The annual update of “The Dragonflies and Damselflies of North Carolina” is now online at <<http://www.dpr.ncparks.gov/odes/a/accounts.php>>. This 6th Approximation (February 2015 version) is ready for viewing and downloading. Click on the dropdown at “Files to Download” and then click “Complete 6th Approximation”. At the dropdown, you will also see the “Checklist for North Carolina”, which is a handy two-page listing of the species, and their statuses and general locations (provinces).


One new species was added to the state list in 2014: Flag-tailed Spinyleg (*Dromogomphus spoliatus*). Owen McConnell photographed one in Graham County, not too far from Tennessee, so this is a very slight eastward range extension. In addition, there is now considerable concern about the native status of Little Bluet (*Enallagma*

*minusculum*) in the state; it may well have been introduced.

If you have downloaded previous versions, you will note that the range maps for South Carolina are now missing from the PDF species accounts (though they have never been present on the website maps). Though we have populated new county records for South Carolina when we hear about them, we have gotten few such data in recent years; thus, the comparison between the heavily populated county maps for North Carolina versus the poorly populated county maps for South Carolina was bothersome and not visually appealing. We may include South Carolina on the PDF maps with the next approximation, pending release of county-level data from other websites and data sources.




We hope you enjoy the version, and, we hope that many of you continue to input your odonate records on the website. The website has a data input function, though the user must have a username and password for data entry. Please contact Tom Howard <tom.howard@ncparks.gov> if you have odonate records from North Carolina that you wish to enter, and he will provide you with information about logging in to the website for data entry. Note that the

website is automatically updated every time records are entered (e.g., a new county record will show up on the range maps immediately, and the flight charts as visible on the PDF for a species will change). Please keep this in mind if you print out the full PDF approximation; it won't be updated until a year from now. Nonetheless, some or many of you may want to print out the full PDF now, before the odonate season starts. 

## Banded Pennant (*Celithemis fasciata*) with Greatly Reduced Wing Markings

Rick Nirschl <ricknir@hotmail.com>

These photographs of a Banded Pennant, *Celithemis fasciata*, were taken near Toledo, Lucas County, Ohio on 26 August 2014. They show an individual with greatly reduced wing markings. The amount of black markings on the wings does differ between the northern and southern populations of this species, with the northern populations having reduced markings. This individual is either an extreme example of that difference or simply aberrant.

*C. fasciata* is not a common species in northwest Ohio and it has only been recorded in 11 of Ohio's 88 counties. The location where these photos were taken has a very small breeding population, which is the only population that I know of within about 70 miles of Toledo. In the eight years that I've been monitoring the Toledo site, this is the first time I've seen an individual with such reduced wing markings. 



Unusually marked Banded Pennant (*Celithemis fasciata*), Lucas County, Ohio, 26 August 2014. Both are of the same individual.

### DSA Has a New Mission Statement

At the 2014 annual DSA meeting in Wisconsin, assembled members discussed, modified, and voted on a new mission statement for the DSA set forth by the Executive Committee:

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

This mission statement has been added to the home page of OdonataCentral <<http://www.odonatacentral.org/index.php/PageAction.get/name/DSAHomePage>>, and you will also find it from now on in the inside back cover of every article of ARGIA. Thank you all for everything you do to help promote and fulfill the mission of the DSA!

# Mass Ovipositing Aggregation in *Argia insipida* and Aerial Aggregation in *A. insipida* or *A. translata* (Dusky Dancer) in Central Suriname

Marcel Wasscher <marcel.hilair@12move.nl>

Of the nine species of *Argia* known from Suriname, *Argia insipida* Hagen in Selys and *A. translata* Hagen in Selys (Dusky Dancer) are perhaps the best known. Both species are fairly common at rivers in the interior of Suriname, the first mainly near rapids, the second also along quieter parts of the rivers. Dirk Geijskes described the larvae of these species in 1943 and 1946, respectively (Geijskes, 1943, 1946).

In August 2011 and July–August 2013, I spent some weeks at the Tapanahony River (a tributary of the Marowijne River) in the interior of Suriname. Here I stayed either at Drietabbetje (in 2011, at N 4°6'53.61", W 54°40'31.79" in 2011) or Puketi (in 2013, at N 4°7'32.23", W 54°37'39.76"), spending 2 or 3 weeks respectively at each site.

## Mass Oviposition in *Argia insipida*

In the afternoon (15:30–16:15) of 21 July 2013, in rapids in the Tapanahony at Futopassie just north of the village of Puketi, I saw many males and ovipositing tandem pairs of *Argia insipida* settled on a common water plant of rapids, the pink-flowering *Mourera fluviatilis* Aublet, 1775 (Fig. 1). There was a total of over 200 individuals in one location and as many as 20 males and 12 tandem pairs gathered together in a square metre, with just a single tandem of *A. translata* found mixed in between (Fig. 2). Generally numbers of Zygoptera are low in Suriname, and I had never seen such an aggregation of damselfly before. I observed this behavior only on that specific day; I saw no aggregations on days both before and after. All aggrega-



Figure 1. Rapids in a tributary of the Tapanahony River near Puketi, with flowering *Mourera fluviatilis* Aublet, 1775.



Figure 2. Many ovipositing and male *Argia insipida* on leaves of *Mourera fluviatilis* in a rapid on 21 July 2013, with one ovipositing tandem of *A. translata* in front.

tions of *A. insipida* were mature adults but the species was still emerging on later dates.

In the database of the Odonata of Suriname at Naturalis (Leiden, The Netherlands), there is only one day where many specimens of *A. insipida* were collected. This was on 24 July 1963, when H. Pijpers collected 27 males and 10 females at 16:00 at the Lucie river (approx. N 3°31'6", W 56°27'19"), also in Central Suriname. This date is close to the one reported here, both being at the end of the long rainy season (Fig. 3). The database shows *A. insipida* was not collected in Suriname during June, and *A. translata* only once (on 25 June 1944). There are no records of *A. insipida* collected between 30 May and 9 July, or of *A. translata* collected between 30 May and 5 July (except for the 25 June 1944 record). The rainy season was heaviest (mean = 26 days of rain; 325 mm total rainfall) at Drietabbetje in May, and less so (24 days of rain; 250 mm total rainfall) in June. The time of day is in both cases unusual compared to Querino and Hamada (2009), who observed near Manaus (Brazil) the highest oviposition activity of *Argia insipida* in October 2003 and July 2004 at 13:30.

Similar though less crowded aggregations of ovipositing pairs of *Argia* have been photographically documented twice: *A. insipida* in French Guiana at Montsinéry-Tonnégrande on 11 November 2012 by Denis Gaschignard (in litt.); and an undescribed species of *Argia* photographed in Guyana by Natalia von Ellenrieder (in litt.). It has also been seen for *A. barretti* (Comanche Dancer) in Mexico and *A. oenea* (Fiery-eyed Dancer) in Arizona by Rosser Garrison (in litt.).

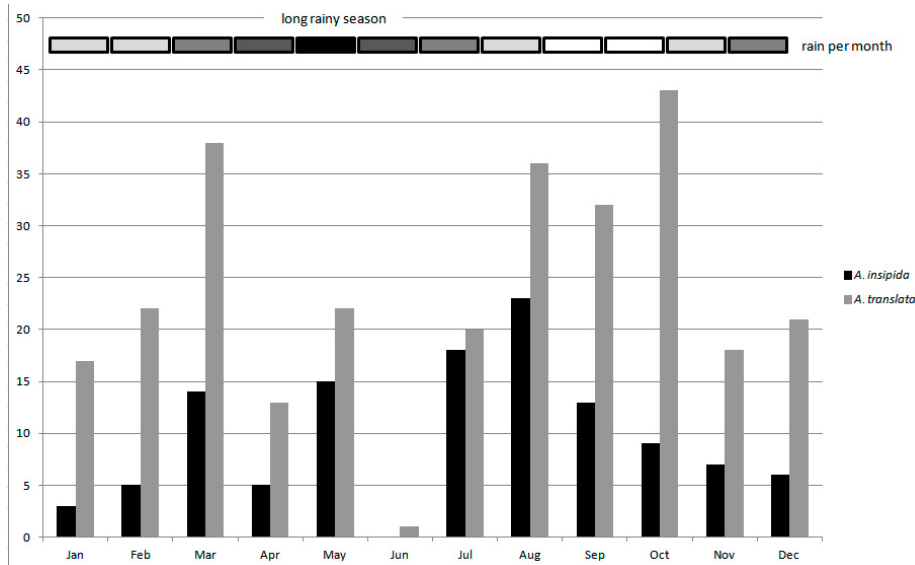


Figure 3. Number of *Argia insipida* and *A. translata* collected per month in Suriname during 1900–1980 (database of the Odonata of Suriname at Naturalis, Leiden, The Netherlands). Top bars show mean rainfall per month at Drietabbetje, from 350 mm/month (black) to 50 mm/month (white).

### Perching on Bare Tree Twigs

In 2011 at Drietabbetje I sometimes saw large *Argia* spp. sitting at a height of 5 m on the bare twigs of trees along the river. I saw similar behavior again in 2013. At first I saw it several times along the river and in clearings in the forest, up to 200 m from the river. Individuals all sat on bare twigs at from 1–10 m, and many could be identified as either *A. insipida* or *A. translata*. Near rapids I saw them sitting at a height of up to 10 m. Although these individuals could not be netted, they were photographed (Fig. 4). One female was certainly *A. insipida*, and it is most likely that these individuals were all *A. insipida* and/or *A. translata*. The ratio of male to female was roughly 1:1.



Figure 4. Female *Argia insipida* or *A. translata* on a bare twig in the treetops. Arrow indicates a blurred hovering individual of one of these species (thorax right and abdomen left).

They sat from 25 cm to some metres away from each other, with 20 individuals along a stretch of 50 m. Rosser Garrison (in litt.) informed me of some *Argia* species that are known to live high in trees: “We have seen some species of various *Argia* from a fogging project at canopy sites in Ecuador several years ago: *Argia difficilis* Selys, *A. indicatrix* Calvert, *A. fumigata* Hagen in Selys, *A. collata* Selys and *Argia* n.sp.”.

### Aerial Aggregation


On 29 July 2013 I was focusing my binoculars on these high-perching individuals in the bare treetops near strong rapids in a tributary of the Tapanahony directly northwest of the village of Puketi. Above these individuals sitting at a height of roughly 10 m, I saw a loose group of five *Argia*, probably males, hovering a further 5 m up in the air, always with their head pointing downstream. Using 50x zoom, a photo could be taken (Fig. 4). This behavior was seen between 14:00 and 14:30. One male came out of the air and landed not in a treetop but in a tree at a height of 3 m. On 31 July at 13:45 this hovering at a similar height was seen at the same locality for two *Argia* spp. This kind of aerial aggregation behavior has been described for a protonetoneurine *Protoneura cara* Calvert (Orange-striped Threadtail) in Mexico (Gonzalez-Soriano, 2001), but as far as I know has never been described for other Coenagrionidae or for *Argia* spp. In this case, it’s most likely *A. insipida* and/or *A. translata*.

### Acknowledgements

Thanks are due to my accompanying friends in the field: Johan van’t Bosch, Wouter Wakkie and Ruth Langemeijer in 2011, and Auke Hielkema in 2013. Much thanks are due to Adrian Parr and Rosser Garrison for checking the English language and helping me to improve the article.

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## Call for Papers for BAO

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


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

## DSA Treasurer's Report for 2014

Jerrell J. Daigle, DSA Treasurer <jdaigle@nettally.com>

Currently, we have a DSA membership of about 315 members. We began 2014 with a balance forward of \$23,652.59. Our year-end balance is \$25,655.44. Our expenses were: the incorporation fee (\$61.25); a southeast regional meeting expense of \$83.00; \$363.47 for DSA annual meeting buttons; \$126.27 for a DSA award; and a loan of \$1,182.23 for DSA t-shirts which was later paid in full with interest. Funds to support development of the new dragonfly apps by David Bell were provided by DSA (\$3,000) and two anonymous donors (\$3,000 each). The 2014 Donnelly USA travel grant of \$500.00 went to Tim Vogt. We also

submitted payment of \$1,032.00 to the University of Texas for computer storage space for ARGIA and BAO. Future computer storage space for 2015 was invoiced and paid for by the funds gained through the annual meeting silent auction. We agreed to hold DSA Costa Rica 2015 trip registration fees and guide stipends in the DSA account.

All expenses must be approved by two Executive Committee members, other than the Treasurer. Detailed quarterly treasurer's reports were sent to all Executive Committee members. 

## Odonata in the News

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

DuBois R.B. and K.J. Tennessen. 2015. How did E.M. Walker measure the length of the labium of nymphs of *Aeshna* and *Rhionaeschna* (Odonata: Aeshnidae)? *Great Lakes Entomologist* 48(1–2): 79–92. Walker's studies on nymphs of these genera have guided taxonomists for years, but there is uncertainty regarding how his labium measurements were made. The authors recalculated maximum length/width ratios from dimensions of Walker's illustrations in publications throughout his career, and found that in his early works, Walker restricted measurements to the prementum (not including the visible portion of the postmental hinge), and in later years he included the postmental hinge in measurements of some species. The length/width ratios calculated by each author independently were similar both for a given species and to Walker's published

values. This high level of repeatability affirms the usefulness of this character in species determinations within these genera. The authors further recommend specific techniques for performing labium measurements.

McCauley, S.J., J.I. Hammond, D.N. Frances and K.E. Mabry. 2014. Effects of experimental warming on survival, phenology, and morphology of an aquatic insect (Odonata). *Ecological Entomology* DOI: 10.1111/een.12175. The study examined the response of nymphs of *Pachydiplax longipennis* (Blue Dasher) reared at three different temperatures designed to mimic current environmental conditions and the temperature increases predicted due to global climate change in the next 50 and 100 years (2.5°C and 5°C higher, respectively). The lowest survival rate was seen at the highest temperature, and these nymphs emerged as adults up to three weeks earlier than those reared at ambient temperatures, although overall body size remained the same. These results suggest that climate change will result in substantial changes in the phenology of some Odonata.

Hall A.M., S.J. McCauley and M-J. Fortin. 2015. Recreational boating, landscape configuration, and local habitat structure as drivers of odonate community composition in an island setting. *Insect Conservation and Diversity* 8(1): 31–42. The influence of various factors on the composition of odonate communities in 17 islands in the Georgian Bay area of Lake Huron was examined, including recreational boat use, a serious stressor in freshwater coastal wetlands. Boats can impair water quality, damage habitat physically, act as vectors for transporting invasive species, and the wave action they cause can swamp emerging odonates and dislodge nymphs from vegetation. The results of monthly surveys throughout the summer that noted both adult abundance and exuviae showed that most gomphid species were found as nymphs where exposure to wave action from boats was minimal. Vegetation was an important predictor for abundance of both life stages, but for adults the amount of shaded coastline was also important, while a shallow sloped shoreline was more important for nymphs. Conservation planning must include consideration of differing stressor impacts on nymphs and adults. Relocating boating channels and/or altering speed limits could help conserve odonates in high traffic areas.


Kaunisto K.M., P. Kaunisto, V. Vahtera, and J. Suhonen. 2015. Populations of the damselfly *Coenagrion hastulatum* at the edge of the species range have fewer gregarine and water mite parasites. *Freshwater Biology* 60(4): 794–801. Metapopulation theory predicts that the further a host population is from other populations in its range, the harder it will be for a parasite to colonize it. However, populations at the edge of their range may be more stressed and thus more vulnerable to parasite infestations. The prevalence of ectoparasitic (external) water mites and endoparasitic (internal) gregarine protozoan parasites on the damselfly *Coenagrion hastulatum* was studied, from the dense populations in southern Finland through those at the northern edge of the species' range. Only sexually mature individuals were examined; teneral and old adults were excluded to avoid age-related bias in parasite loads. Water mite loads were enumerated by counting mites and attachment scars on the exoskeleton; specimens were then dissected and the guts examined for gregarines. Prevalence of both water mites and gregarines decreased towards the edge of *C. hastulatum* distribution, where populations are more isolated, and damselfly populations parasitized by one type of parasite generally had higher numbers of the other. Lower parasite prevalence in host populations at the edge of their range may increase the ability of host populations to persist there.

Futuhashi R., R. Kawahara-Miki, M. Kinoshita, K. Yoshitake, S. Yajima, K. Arikawa, and T. Fukatsu. 2015.

Extraordinary diversity of visual opsin genes in dragonflies. *Proceedings of the National Academy of Science* 112(11): E1247–E1256. Human color vision is tri-chromatic; we have three opsins in our cone receptors that are sensitive in the red, green, and blue regions of the spectrum (RGB). Dragonfly vision turns out to be dramatically different. Researchers sequenced RNA in adult and larval eyes of odonates in 11 families and 12 species, and found 15–33 opsin genes, of which 11–30 are visual opsins. Visual opsins included UV, short wavelength, and long wavelength types. These genes are expressed differentially during development; in nymphs, only one short wavelength and a few long wavelength genes are expressed, reflecting the lesser degree of importance of vision in nymphal hunting as well as the long wavelength-type light conditions in their aquatic habitats. In adults, different types of opsin genes were expressed in different spatial regions of the compound eyes, with differences between the dorsal and ventral regions, and a specific long wavelength gene was expressed in ocelli.

Edgehouse, M. and C.P. Brown. Predatory luring behavior of odonates. 2014. *Journal of Insect Science* 14(146): 1–3. This study describes the first indication that odonate nymphs may use abdominal movements to lure potential prey into striking distance. *Aeshna palmata* (Paddle-tailed Darner) nymphs were placed in containers with both mysid shrimp and *Argia vivida* (Vivid Dancer) nymphs as potential prey. In some cases the darner nymphs pursued and ate the shrimp, but in others, when the two nymphs were oriented head-to-head, abdominal movements interpreted as luring behavior were seen. Luring behavior consisted of slow swaying abdominal movements that caused the lured nymph to change its body orientation, followed by rapid abdominal movements that may imitate the appearance of other prey and thus lure the other nymph towards the caudal region of the aggressor, leaving it vulnerable to attack.

Hämäläinen, M. 2015. Catalogue of individuals commemorated in the scientific names of extant dragonflies, including lists of all available eponymous species-group and genus-group names. *International Dragonfly Fund, Report 80: 1–168*. This beautifully illustrated catalogue notes 1257 people commemorated in the scientific species, subspecies, genus or subgenus names of extant dragonfly species. Each entry gives a brief description of the person thus honored, along with their relationship to the individual who described the species (known or in some cases speculative). Many people have achieved odonate-related immortality, as it was calculated that of the ~8400 available species-group names in extant Odonata, 23% are eponyms, with 42% of new names created from 1995 to 2015 being eponyms.

Dragonfly gut infections suggest environmental role in obesity <<http://news.psu.edu/story/344459/2015/02/11/research/dragonfly-gut-infections-suggest-environmental-role-obesity>>. Researchers at Penn State are adding invertebrates to the list of groups studied for “infectobesity”, an emerging field of research that examines the infectious origins of obesity. Nymphs and adults of *Libellula pulchella* (Twelve-spotted Skimmer) are being subjected to a variety of environmental conditions, including different pH levels, to determine how susceptibility to infection with protozoan parasites is changed, and what effect those parasites have in turn on flight performance and fuel use. Preliminary data indicate that lower pH (i.e. higher acidity) is linked to increased susceptibility to infection, and that infected dragonflies show a change in their community of gut microorganisms, similar to that seen in studies of obesity in mammals. If you’re wondering whether you’ve ever seen a fat dragonfly (apart from the invariably inflated-looking Four-spotted Skimmer, *Libellula quadrimaculata*), note that since the rigid exoskeleton of an insect can’t expand much, obesity in insects is seen mainly as an increased density of fat packed into the muscle tissue. 

## How I Fell Into the Clutches of the Odonata

This feature presents essays from DSA members that describe how, when, where, and why they first became interested in Odonata. It also doubles as a fun way for members to find out a little more about each other.

If you would like to contribute, write a short essay describing your first forays into the world of Odonata and how it has affected your life since, including your most interesting ode-hunting tale, and send it to the Editor at <[celeste@xerces.org](mailto:celeste@xerces.org)>. Accompanying pictures to illustrate the tale are also welcome.

Whether you just discovered odonates this spring or have pursued them for decades, I know there are plenty of interesting, entertaining, and inspiring stories out there to be told!

## Book Review: Dragonflies of Texas: A Field Guide, by John C. Abbott

Thomas W. (Nick) Donnelly <[tdonnelly@binghamton.edu](mailto:tdonnelly@binghamton.edu)>


**Dragonflies of Texas: A Field Guide.** John C. Abbott. University of Texas Press, 466 pp. Paperback \$27.95 ISBN 978-0-292-71448-9.

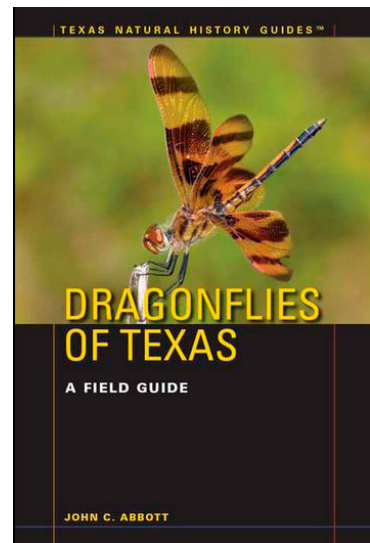
In 2011 John Abbott published “Damselies of Texas: A Field Guide”. This guide set a very high standard for his inventive use of art work and photomicrographs for the bulk of the illustrations. The present book follows the format of the damselfly guide, but with field photographs rather than art work for the main illustrations.

The dragonfly book starts with a long introduction containing sections on morphology, life history (with illustrations of immature stages), and reproduction. Texas biotic provinces are discussed, along with conservation considerations aimed at the less common Texas species. Finally, collecting techniques and the curating of specimens are thoroughly covered.

The prime value of this guide is its extensive presentation of information on the individual species, including habits and habitat. The photographic illustrations are

excellent and several of the more difficult genera are illustrated with very nice photomicrographs of important details. It is difficult to see how any dragonfly enthusiast in Texas can function without this guide, and workers in nearby states (especially New Mexico, Oklahoma, Louisiana, and Kansas) will find essentially their entire dragonfly fauna covered here.

This is probably the most valuable regional guide to appear in several years, and workers in the south-central states will need a copy. 



## Parting Shots

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

### Escape to Costa Rica

Larry Barnett <lbarnett25@gmail.com>


While waiting for spring to come to central New York, Larry took a cruise to Central and South America. He came upon this mating wheel of *Megaloprepus caerulatus* (Blue-winged Helicopter) while hiking in a rainforest in Limon in Costa Rica and was amazed at their size. These damselflies are named for their prodigious wingspans, the largest of any extant dragonfly or damselfly, which can reach up to 19 cm in large males. Those of us heading to Costa Rica in June for the DSA regional trip have our appetites whetted!



### A Story With a Twist

Marion Dobbs <ecurlew@icloud.com>

While wandering along a small wooded stream in Chattooga County Georgia a few years ago, Marion managed to catch “before and after” photos of this Cherokee Clubtail (*Gomphus consanguis*) doing some fancy maneuvering to

clean its eyes. Marion reports “I have a few images of various species, both damselflies and dragonflies, displaying this 180° head rotation, but not many with before and after shots. According to Dunkle (Dragonflies through Binoculars, 2000), dragonflies have “a comb of flat bristles on each front leg...used to brush dust and water off the eye.” Almost invariably, I see that foreleg positioned at the front of the eye when the head is turned, supporting evidence that this behavior is associated with grooming.” 



## **ARGIA and BAO Submission Guidelines**

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

### **Articles**

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

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

### **Figures**

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

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

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

### **Tables**

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



# The Dragonfly Society Of The Americas

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

## Executive Council 2013–2015

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## Journals Published By The Society

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

**Bulletin Of American Odonatology** is devoted to studies of Odonata of the New World. This journal considers a wide range of topics for publication, including faunal synopses, behavioral studies, ecological studies, etc. The BAO publishes taxonomic studies but will not consider the publication of new names at any taxonomic level.

## Membership in the Dragonfly Society of the Americas

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

## 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)** Common Green Darners (*Anax junius*) ovipositing, Forest Beach Migratory Preserve, Ozaukee County, Wisconsin, 8 July 2013. Photo by Freda van den Broek. **(lower)** Gray Petaltail (*Tachopteryx thoreyi*), Rockland County, New York, 31 May 2012. Photo by Walter Chadwick.

