MIGRATORY DRAGONFLY PARTNERSHIP
Citizen Science Annual Report

Spring 2015 | VOL 3
TAKING FLIGHT

IN THIS ISSUE...
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In December 2010, a small group of people came together in Austin, Texas from places as far-flung as Ontario, Canada; Veracruz, Mexico; Seattle, Washington; and Washington, D.C. Our goal was to discuss what seemed to be an almost crazy idea: the formation of an international partnership focused on the study of dragonfly migration in North America. We created a name, a mission statement, and spent two days developing an action plan for this ambitious project. So much of what we planned has come to fruition; in this newsletter you’ll read about the progress that’s been made by the Migratory Dragonfly Partnership as we enter our 5th year, our plans for the next five years, and the insights we’ve gained into this phenomenon, in which all of you have played an important part.

As an entomologist, conservationist, and wild-eyed dragonfly enthusiast, the work of the MDP has been immensely satisfying on a professional level—but it’s brought many benefits on a personal level as well. I’ve chased dragonflies in fens in Saskatchewan and pantanos in Tabasco, stumbled across pitcher plant bogs in New York, and laid eyes on my first Great Horned Owl in Vermont. I’ve learned to speak Spanish, taken tentative steps down the road to becoming a birder, eaten tropical fruits I’d never heard of before, and spent time in the field with odonate specialists I respect and admire. And last but definitely not least, I have gotten to interact with hundreds and hundreds of people from across the continent who all have one thing in common—a genuine desire to learn more about dragonflies and take part in our studies of their migration. With your continued help, as our work expands in the coming years, we will be able to fully explain the process of dragonfly migration in North America, and take more conservation actions to protect both dragonflies and the habitats they need to survive.

A Look Ahead: MDP in 2015

The MDP Steering Committee Meeting held in Portland, OR in February 2015 reflected on the advances made by the partnership and the contributions of its dedicated citizen scientists to the study of dragonfly migration. Not only did we discuss our accomplishments, we also laid out key next steps to guide the future of MDP. Looking ahead, we explore ways to make the website more interactive, expand Spanish-language resources, and support our ever-growing network of citizen scientists and partners. We hope you’ll join us again this year on our continued quest to piece together the migratory journey of dragonflies.

The Migratory Dragonfly Partnership uses research, citizen science, education, and outreach to understand North American dragonfly migration

dragonfly@xerces.org  •  www.migratorydragonflypartnership.org
Participation in MDP citizen science programs has increased steadily since their inception in 2012. In these three years of monitoring, we have increased awareness of issues in dragonfly migration and conservation among thousands of MDP citizen scientists, partners, and professionals from Canada to Mexico. Participants have registered 2090 unique monitoring sites across North America. And with over 11,000 Migration and Pond Watch records, we are already gaining a better understanding of the flight paths of migratory dragonflies, first flight dates of Common Green Darners and the movement of this species north in spring. From citizen scientists submitting observations made at their local ponds, to organized Master Naturalist groups recording the dragonfly fauna at wildlife refuge ponds in Minnesota, to partners monitoring migrating dragonflies at hawk watching posts from Canada to Mexico—each data set brings with it not only a number of observations, but also the realization that MDP projects have an expansive geographic scope and have fostered a variety of successful partnerships. This year MDP will work to expand our network of monitors and partners by reaching out to additional Master Naturalist groups, who often have links to wildlife refuges and nature centers that are eager to describe the fauna of the lands they manage. In 2014, volunteer naturalists in Sherburne, Minnesota maintained their lead for a second year in Pond Watch data reporting for the ponds on the Sherburne National Wildlife Refuge. Continued long-term reporting by partners and citizen scientists is vital to detect changes in range status that may occur due to impacts from climate change and habitat loss, which will enable us to work toward the conservation of these animals and the freshwater habitats they depend on for survival.

Over 1,000 MDP participants have registered more than 2090 unique sites across North America!

**Citizen Science**

*Citizen participation in scientific research is the foundation of MDP projects*

Citizen science is shaping the way we think about the natural world. Public participation in scientific projects is not a new concept; in fact, monitoring programs such as the Christmas Bird Count have been informing research projects and species conservation efforts since 1900. Volunteer scientists remain the core foundation of progress achieved through many research projects across the globe, and MDP projects are no different. Collaborating with thousands of volunteers and partners from British Columbia, Canada to Cardel, Mexico, from San Francisco, California to Cooper, Maine, a legion of MDP supporters have gathered to further our understanding of migration in dragonflies, and protect and value the wetlands and other aquatic habitats these species depend on for survival.

This year, MDP was among a global audience that gathered in San Jose, California for the inaugural conference of the Citizen Science Association (CSA). Over 600 scientists, volunteers, data managers, and educators from 25 countries shared insights about the frontiers, challenges, and best practices related to the science of citizen science. In many ways, the conference was a chance to build connections across a variety of disciplines and exchange ideas on the many ways to engage with different audiences.

Citizen scientists from around the globe with varying levels of expertise participate in scientific research, from amateur birders in their backyards to expert dragonflyers monitoring species for regional bioblitzes. Each level of participation in wildlife monitoring contributes significantly to a growing body of information about the natural world and informs conservation efforts for vulnerable species and habitats.

Participating in global conferences like the CSA helps us think about what is and isn’t working for our volunteers, discover Best Management Practices and new strategies for engaging the public in research projects, and learn from other programs. Adaptive management includes facilitating communication among participants, providing feedback mechanisms, including sharing data and reports, and finding ways to help keep volunteers motivated and engaged for the long-term.

So remember, as an MDP volunteer, you’re not just connected to an intercontinental network of other dragonfly monitors, you’re also part of a worldwide network of citizen scientists!
Not Just for the Birds: Hawk Watchers Contribute Valuable Data to Another Successful Year of Dragonfly Migration Monitoring

Migration, one of nature’s greatest spectacles, is celebrated every year across North America as birds from Canada to South America take to the skies. Hawk Watchers have been counting raptors since the 1970s—and they often make informal notes of dates that also saw large numbers of dragonflies passing by. In 2013, HMANA partnered with the Migratory Dragonfly Partnership (MDP), a group dedicated to the long-term study of dragonfly migration in North America, to formally incorporate daily dragonfly observations and counts into the fall monitoring protocols of participating Hawk Watch sites. HMANA partnered with MDP again in 2014 to continue monitoring efforts and help increase our understanding of dragonfly migration.

We know from observers at Hawk Watch sites across North America that other winged migrants, including monarchs and dragonflies, often join this epic journey both north and south, sometimes serving as an in-flight snack for the birds. Migrating dragonflies and birds noted at Holiday Beach Conservation Area—a hot spot of migratory activity in Ontario where dragonflies fly past the tower along the shore of Lake Erie—were joined by monarchs heading south on 7 September 2014.

Researchers and citizen scientists have joined forces for decades to study migration in both birds and monarchs, but most reports of dragonfly migration have been opportunistic and anecdotal, with no organized central reporting systems, and so the full extent of migration in dragonflies still remains unclear.

However, after just a few years of coordinated monitoring by dedicated observers, we are already seeing trends in dragonfly migration. Fall migration in eastern North America begins near the end of August and can continue into October, although numbers are usually highest in September (see graph), while migration on the west coast begins about two weeks later. Within that span, some days see enormous spikes in the number of passing dragonflies while others have no activity at all. Migration intensity may vary from year to year; two pulses in 2014 occurred early in September, but peak numbers were seen later in 2013. In 2014, Lighthouse Point experienced the highest one-day migration pulse of almost 6,000 dragonflies on 7 September, and Hawk Ridge and Illinois Beach both witnessed peak dragonfly numbers (>6000) on 2 September. The two Midwestern strongholds of Hawk Ridge and Illinois Beach were also champions in overall reporting, with 151 and 95 observations submitted, respectively. Because dragonflies skirt coastlines, preferring not to fly out over open water, raptor monitors at these Great Lakes sites are ideally placed to witness large groups of migrants funneling past observation sites.

The species composition of migratory flights along the east coast appears consistent, based on two years of observation data. In 2013, North America’s common eastern migrants, Common Green Darners and Black Saddlebags, were observed in the highest proportions compared to other species (36% and 24% of reported migrants, respectively). These two conspicuous dragonflies were again the most abundant species on the wing in 2014. Common Green Darners comprised 33% of all dragonflies counted in 2014, and were seen on 39 out of 58 count days and in all of the large flights reported. However, we know from other observations made by MDP partners along the east coast of Mexico that these two species are seen in much lower proportions compared to the tropical migrants, Spot-winged Gliders and Wandering Gliders, raising the interesting possibility that Common Green Darners and Black Saddlebags that originated in the north may stop for the winter in northeast Mexico or Florida. In addition, reports from Hawk Watch sites include frequent mention of Twelve-spotted Skimmers in mixed-species dragonfly flights. This species was not initially considered by MDP to be a regular migrant, but Hawk Watch data suggest otherwise. Additional observations from sites further south will help us discover whether the annual movement of Twelve-Spotted Skimmers seen in 2013 and 2014 is a localized northern phenomenon or if migrants of this species continue moving further south.

Questions such as these highlight our need to increase the network of MDP observers not only throughout the east coast of North America down into Florida, but also to the west in Texas and northern Mexico. We hope to develop relationships with additional HMANA partners from British Columbia down into Baja in the future, to investigate the extent of migration on the west coast and the continued southward movements and potential overwintering grounds of our main western migrant, the Variegated Meadowhawk.
By the end of the 2014 migration season, over 1,300 individual species records had been collected from 40 Hawk Watch monitors at 19 participating observatories. These observations are already informing our understanding about the main migratory species throughout the east coast and providing insights into the full geographic extent of migration.

As we look ahead to our third migration season in 2015, we hope that previously participating Hawk Watch sites as well as new sites will join us in monitoring dragonflies. Because dragonfly migration is sporadic and discontinuous, Hawk Watchers are integral to this study, and sustained long-term observations are crucial to our ability to determine the nature and extent of this phenomenon. Continued collaboration this year will provide more critical data and help us investigate late-season emergence and flight behaviors of migratory dragonflies.

The MDP would like to express our gratitude to all of our partners at HMANA who worked to add dragonfly counts to the Hawk Watch data collection system and to the monitors and observatories that participated in 2013 and 2014, including: Botsford Hill; Carter Hill; Chestnut Hill; Cooper, Maine; Grandfather Mountain; Hanging Rock Tower; Harvey's Knob; Hawk Mountain; Hawk Ridge; Holiday Beach Conservation Area; Illinois Beach SP; Kiptopeke; Lighthouse Point; Mahogany Rock; Middle School; Pack Monadnock; Rocky Knob; Rose Tree Park; and Wildcat Ridge.

We look forward to another successful year of dragonfly migration monitoring at Hawk Watch sites throughout North America!

Spring and Fall Migration Monitoring

Are you a Hawk Monitor? Please Consider Adding Dragonfly Migration Monitoring to Your Monitoring Location

This year, we are interested in broadening our efforts at Hawk Watch sites, both by engaging sites throughout the western reaches of North America and by gathering information from participating sites about dragonflies’ northward spring migration. The offspring of dragonflies who moved south for the winter migrate north in spring and early summer to breed in ponds and wetlands in northern North America, but their movements occur across a much broader spatial and temporal front than those of fall migrants. Establishing monitors at additional sites and seasons will give us a more complete picture of migration activities and pathways in North America. Please consider monitoring dragonflies as they head north in spring and south in the fall and help the MDP collect long-term data on the movements of migrating dragonflies!

Sites interested in participating should contact Site Coordinator, Julie Brown at brown@hmana.org.

For more information about HMANA’s involvement in MDP, monitoring guidelines, and protocol, please visit http://www.hmana.org/migratory-dragonfly-partnership.

2014 Hawk Watch Dragonfly Migration Data

Hawk Watch Observers: 19 Individual Hawk Watch observers collected dragonfly migration data.

Observatories: 14 participating observatories include locations on the east coast of the US and two Midwestern states, as well as one location in Ontario, Canada.

Numbers: Hawk Watch observers reported over 23,400 dragonflies passing through their sites from mid-August through October 2014.

Who did they see?: The majority of dragonflies seen migrating were Common Green Darner and Black Saddlebags. Other species seen were Twelve-spotted Skimmer (Libellula pulchella) and Autumn Meadowhawk (Sympetrum vicinum). A small proportion of flights were made up of Wandering Glider; with a few sightings of Spot-winged Glider and the more western migrant Variegated Meadowhawk.
**Migration**

Not only have they been fortunate enough to witness the fascinating phenomenon of raptor migration, Pronatura partners in Veracruz, Mexico boast staggering numbers of dragonflies that often migrate coincident with the birds that are heading south. Over the course of many years of raptor observations, our dedicated partners to the south have noted the regular movement of migrating dragonflies from August through October, and even November. More than 2,400 dragonfly migration reports were collected by Pronatura staff in 2013 during the fall migration season along the Gulf coast of Mexico!

Reports from two monitoring locations in 2014 provided an additional 4,700 observations. In 2013, peak migration days occurred near the beginning of observations in August, and then again in September. In contrast, late peaks in dragonfly numbers were reported from the end of November in 2014.

These data are being analyzed with other reports from citizen scientists to understand connectivity between migratory populations throughout North America. After a few years of monitoring, some patterns are being revealed; for example, the tropical migrants Wandering Glider and Spot-winged Glider dominate these epic southerly flights. The reports from Mexico don’t show high connectivity with migration reports from eastern North America, which are composed primarily of Common Green Darner and Black Saddlebag, but expansion of monitoring throughout the southern US and northern Mexico will provide additional information about whether these species continue into northern Mexico or overwinter in the southern US.

**Pond Watch**

Just as Pronatura has been a successful partner in migration monitoring, they have also embraced the life history aspect of Pond Watch. Pond Watch remains a popular project among organizations whose mission includes environmental education. This year, Pronatura Veracruz staff will create a pond at their nature center in Chichicxaltle as an educational opportunity to teach the public about the Pond Watch program and the life cycle of dragonflies. Place-based learning centered around aquatic habitats has the added benefit of teaching people of all ages about the importance of healthy, functioning habitats and the decline of freshwater habitats worldwide.

We are excited to see the most southerly Pond Watch program come to fruition this year!
The developers of the popular eBird smartphone apps BirdLog and BirdsEye are bringing their experience with these widely used bird finding and bird reporting apps to new groups of species on the wing—dragonflies and damselflies. Coming soon to the dragonfly world are two new smartphone apps—the first app, BirdsEye for dragonflies (Dragon’sEye?), will help you find and identify dragonflies and damselflies in your area and the second will allow you to submit species sightings directly from your phone.

With the goal of bringing together naturalists and photographers, BirdsEye apps creator David Bell in collaboration with the MDP and its sister site OdonataCentral, will bring nature to the fingertips of dragonfly and damselfly enthusiasts across North America. Like those that came before them, these apps will be simple, indispensable, and interactive tools for dragonflyers in the field. The dragonfly finding app will allow you to:

- See dragonflies and damselflies reported near you
- Browse detailed maps of dragonfly sightings, nearby or throughout North America
- Track your personal species lists
- Find hotspots near you or where you are headed, and plan your next trip

The dragonfly sightings app will allow you to:

- Plot the exact location of your sightings using your phone’s GPS
- Create new personal locations or choose an existing hotspot or personal location
- Create checklists even when there’s no cell phone coverage for later submission of your dragonfly or damselfly sightings

These two mobile dragonfly apps, though not new to the naturalist community who have been using citizen science apps with great success for years, are new tools for the dragonfly world and will help increase both general reporting of dragonfly and damselfly sightings as well as participation among citizen scientists. Thank you to the donors and developers for their generous support to make these apps a reality this year!

Preorder Dragonfly & Damselfly Finder App

Because birders are interested in more than birds, the BirdsEye Apps creator is supporting citizen science projects for other species on the wing through development of an app that will help users find and ID dragonflies and damselflies in their area.

A second app will allow citizen scientists to report dragonfly and damselfly sightings.

Visit the Birdseye Birding website to preorder your copy of the dragonfly “finding app” today and be one of the first people to beta test the new app!
Unlike other insect migrants such as the monarch butterfly, migratory dragonflies do not overwinter in dense groups. Their extreme mobility and difficulty of capture means that traditional mark-recapture studies are difficult for dragonflies. MDP is therefore using a different kind of mark to infer the movements of individual Common Green Darners: measuring the ratios of stable hydrogen isotopes in the adult wings and the cast-off skin (exuviae) of the final-stage nymph from which the adult emerged. These isotopes are present in the water where a dragonfly develops and remain locked in the wings and exuviae forever afterward. Examining stable hydrogen isotope ratios in exuviae helped us calibrate a latitudinal “isoscape” map, and assessing the ratio in the wings of captured adults allows us to infer the latitude at which the specimen developed and the direction and distance of its movement as an adult. Furthermore, a latitudinal pattern can be seen between first flight dates of Common Green Darner in North America. As the accompanying map illustrates, first flight dates occur later in the year for northern latitudes. This species may be seen as early as February in Florida, while they may not appear until June or July in Canada.

Insights from this work include:

- Adult Common Green Darners collected in the far northern reaches of their range in early spring originated in the far south, meaning that they were migrant adults returning north to breed. Those collected in late summer in the same sites originated in the far north; this population represents the residents emerging locally.
- Both resident and migrant individuals are present during the winter in the southern USA, indicating that not all migrants continue farther south into Mexico.
- The majority of migrant adults found in winter in the southern USA do not survive to make a return journey north but surprisingly, a few individuals may live through the winter and return north the following spring.

Analysis of stable hydrogen isotope ratios in 1,000 wings and 300 exuviae of Anax junius collected in the eastern USA revealed the following:

- The strong positive relationship between isotope ratios in exuviae and wings of teneral (newly emerged) Common Green Darner adults and the known annual isotope ratios in water across eastern North America demonstrate that this is a valid way of determining emergence locality. In addition, specimen age does not affect isotope signature, allowing us to expand our dataset with material from museum specimens.
- Common Green Darners emerge locally in the southern USA (Florida, Georgia, and Alabama) for most of the year.
- Southbound migrants that originated in northern wetlands appear in August and September, and both residents and migrants are present in the southern USA in winter.
- A few of the Common Green Darners collected in Wisconsin, New York, and Vermont in April and May originated in the north; because it is still too early and cold at this time of year for resident nymphs in northern wetlands to have broken their winter diapause (dormancy) and completed development to adults, this raises the possibility that at least some could survive winter in the south and make a round-trip migration.
- Collecting exuviae allows timing of adult emergence to be assessed. The appearance of exuviae at wetlands in the eastern USA echoes the pattern of adult movement. Exuviae appear in a south-to-north direction in spring and then are found in widely scattered locations in mid-summer.
- More exuviae appear in the north in late summer, and by late October exuviae records are present only in the southernmost states. This reflects the completion of development of overwintering resident nymphs beginning in the south in spring and continuing north as temperatures rise, and development and emergence of both residents and migrants in the summer.
- Nymphs hatched from eggs laid by returned migrants in the north in early spring develop rapidly and emerge in late summer as adults that will then migrate south.

Based on our isotope analyses thus far, hypotheses about the movement of Common Green Darner in the eastern US have been verified, but what remains a mystery is the true geographical extent of migration in this species and the longevity of individual migrating dragonflies. To understand the possibility of round-trip flights, overwintering in the adult stage, and the southern extent of migration, future directions include continued expansion of our work into southern Mexico and the Yucatan, as well as the west Indies.
Birds do it, Monarchs do it, Even Dragonflies and People do it....Let’s do it. Let’s Migrate!

Like migrating birds and butterflies that make annual pilgrimages to seek breeding or overwintering grounds, and generally, more favorable conditions during certain parts of the year, dragonflies are seen heading south in congregations and with some regularity every year. The information we have pieced together—working with partners and volunteers monitoring not only freshwater habitats across North America, but coastal regions of both the east and west coasts, and ridge tops of the Rockies, Cascades, and Appalachian Mountains—provides insight into aspects of species’ life histories as well as the timing, intensity, and location of their annual flights in these different regions.

Analysis of data from three years of monitoring indicates that the timing and intensity of migratory flights varies annually. The earliest and latest reports of migratory flights differ between and within species and years by as much as a month during fall migration. Additionally, peak flights of dragonflies heading south occur in September, though peak week can vary from year to year and is often initiated several weeks earlier in eastern North America compared to the west. While in Mexico, peak migratory activity has also been witnessed in September, dragonflies have been seen to continue in large numbers through November. A likely migration scenario is that dragonflies migrating south along the east coast of North America are finally making their way through Mexico just as the raptors do. While the Common Green Darner (Anax junius) is the most frequently reported migrant in the eastern US and Canada, partners in southeastern Mexico are reporting this species in much lower numbers compared with Wandering Glider and Spot-winged Glider (Pantala flavescens and P. hymenaea). This may suggest that more Common Green Darners are overwintering in Florida, but additional research is needed in the southern US and northern Mexico to explore their flight paths and determine if any connectivity exists.

Spring migration on the other hand, appears to be governed by spring temperatures. In fact, in some years Common Green Darners show up in northern locales like Ontario and New York as early as March before resident nymphs could have emerged from their chilly aquatic habitats. This was indeed the case in 2012 (represented in the top map) when warmer temperatures were followed by early first flight dates in the east. But, this was in contrast to 2013 and 2014 monitoring years, when bitter cold temperatures lingered over the south and mid-Atlantic. For the eastern US and Canada this meant that dragonflies didn’t appear in these areas until April or May. This year, while the eastern seaboard continues to thaw out of record snow accumulations, resident dragonflies may again be content to stay below chilly waters waiting to unfurl their wings for the first time; and for the migrants, they will likely remain in warmer climes to the south until conditions are favorable to head north.
Dragonflies and damselflies have the same basic needs as any animal: clean water, abundant food, and places to find refuge, mate, and reproduce. If you’re interested in building your own pond, please consult our Backyard Ponds publication for guidelines on creating and managing pond habitat in your backyard. A couple of items to consider before you take the plunge:

**POND CONSTRUCTION: ELEMENTS TO CONSIDER BEFORE DIGGING YOUR POND**

- Select an area with few overhanging trees
- Designate a minimum viable area of 43 ft² (smaller may also be feasible)
- Consider sinuous, natural-appearing outlines
- Provide habitat with a variety of water depths
- CALL BEFORE YOU DIG. Call local utilities to avoid buried lines
- Deepest depth to consider (2.5–6.5 ft [0.8–2 m]) will depend on pond size and should avoid freezing in deeper parts in winter
- Use a pond liner in well-drained soils
- Install a diversity of plant species and a variety of vegetation types (submerged, floating, emergent, plus shrubs and other upland plants)

A successful backyard pond provides habitat and refuge for all dragonfly life stages. Photo by Celeste Searles Mazzacano.
THANK YOU FOR MAKING A DIFFERENCE

SINCE 2011, OVER 1,000 VOLUNTEERS & PARTNERS FROM CANADA TO MEXICO HAVE CONTRIBUTED NEARLY 12,000 DRAGONFLY OBSERVATIONS!

SIGN-UP FOR MONTHLY MDP E-NEWSLETTERS

CHECK THE MDP EVENTS PAGE FOR UPCOMING EVENTS

Spring is in the Air
Get out and look for dragonflies!

Pond Watch!
START LOOKING FOR DRAGONFLIES AT LOCAL PONDS DURING SPRING MIGRATION

Share Photos
HAVE PHOTOS OF DRAGONFLIES, HABITAT, OR PEOPLE LOOKING FOR DRAGONFLIES?

Resources
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Resources
BE SURE YOU HAVE WHAT YOU NEED TO MONITOR DRAGONFLIES. CHECK OUT THE RESOURCES TAB ON THE MDP WEBSITE

MIGRATORY DRAGONFLY PARTNERSHIP
628 Northeast Broadway, Suite 200
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Using research, citizen science, education, and outreach to understand North American dragonfly migration and promote conservation of the habitats on which they rely

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