Watching the Devil's Horses Pass By

Celeste Mazzacano

The sun is burning off the dawn mist as we jolt down a pot-holed road on the Caribbean coast of Mexico. Cows gaze at us incuriously from wetland pasture on the left, while malachite (*Siproeta stelenes*), yellow-fronted owl (*Caligo telamonius*), and postman (*Heliconius erato*) butterflies are beginning to fly through the forested hill rising to our right. Traveling with Doug Taron of the Peggy Notebaert Nature Museum in Chicago, my destination this morning is a raptor-banding station at Cansaburro operated by Pronatura, a nonprofit organization dedicated to conserving Mexico's wildlife. Our companion on this trip is Elisa Peresbarbosa Rojas, a conservation assistant with Pronatura Veracruz, who draws our attention to a collection of hawks circling lazily in the morning sky. These birds are just a few of the participants in the *Río de Rapaces* (River of Raptors), an annual migration of five million birds of prey—more than two dozen species—flying south over the state of Veracruz from late August to mid-November.

It is not, however, the spectacle of eagles and hawks that has drawn us here on this early-October day. Pronatura Veracruz has monitored this raptor migration since 1991 and, in the course of their counting, they consistently observe other annual migrants: darting swarms of thousands of dragonflies, known locally as *caballitos del Diablo*—the Devil's horses. These flights of dragonflies have also been observed at inland observatories in the cities of Cardel and Chichicaxtle.

The wandering glider (*Pantala flavescens*) holds the record for the longest migration—more than eleven thousand miles—by an insect. Photograph by Netta Smith.

Large, colorful, and easy to identify, the common green darner (*Anax junius*) lends itself well to monitoring by citizen-scientists. Photograph by John C. Abbott.

Migrating dragonflies may be a surprise to many people. The monarch butterfly (*Danaus plexippus*) is the best-known insect migrant, but the aptly named wandering glider (*Pantala flavescens*), a dragonfly found on every continent save Europe and Antarctica, easily dethrones the monarch as the insect long-distance champion. In North America the wandering glider migrates along the East Coast, but it is its flight across the Indian Ocean that is the most remarkable. Riding the monsoon winds, the glider island hops from India to east and southern Africa; subsequent generations return by following the continental coastline back to India. This round trip of more than eleven thousand miles (nearly eighteen thousand kilometers) is almost twice the maximum distance of the monarch's migration.

After negotiating the steep climb to the hilltop banding station, we find ourselves eye-to-eye with a red-faced dragonlet (*Erythrodiplax fusca*) perched motionless on a leaf, its wings drooping forward in the characteristic pose of these small skimmers. A few common green darners (*Anax junius*) flash by, followed by a tandem pair of red saddlebags (*Tramea onusta*) heading south. Doug and I position ourselves in a small thatched blind, doing sets of timed counts to estimate numbers of passing dragonflies. For the first hour, our counts range from twenty-three to thirty-four dragonflies per three-minute interval—as many as 680 in an hour—a promising start to the day. But, as the morning progresses, the winds strengthen, the sky becomes overcast, and dragonfly activity ceases.

Unfortunately, this weather pattern persisted for the remainder of the week and we didn't see any further dragonfly migrations during our stay. This was

The band-winged dragonlet (*Erythrodiplax umbrata*) is one of eighteen dragonfly species in North America that regularly migrate. Photograph by Celeste Mazzacano.

frustrating but these flights are known to be sporadic and discontinuous, with large numbers moving in mass flights for a few days followed by gaps in which few to no migrants are observed, so even had the weather been perfect we still might have seen no dragonflies. Were the ones we counted that first day part of a true migratory cohort or simply a handful of residents moving south along the coast with the winds? This is a question we were unable to answer, and one that will require future study.

Dragonfly migration is not a newly recorded phenomenon; the first written reports of mass migration date back to the mid-nineteenth century. Migrations occur on every continent but Antarctica, and flights are often seen following such topographic edges as ridges, cliffs, coastlines, and lake shores. North America may have as many as eighteen migratory dragonfly species, including the wandering glider; some engage in annual seasonal migrations and others are more sporadic. The best-known migrant dragonfly is the common green darner, which makes mass flights each fall in the thousands or millions, traveling from southern Canada and the northern United States down into the southern United States, northern Mexico, and parts of the West Indies. Midwesterners can follow clouds of migratory dragonflies along the shores of the Great Lakes, while residents of western states may see thousands of variegated meadowhawks (*Sympetrum corruptum*) sweeping south in the fall. Other North American dragonflies that are considered regular migrants are the band-winged dragonlet (*Erythrodiplax umbrata*), the spot-winged glider (*Pantala hymenaea*), and several species of saddlebags (*Tramea*).

Confirming a species as a true migrant is complicated, as dragonflies are strong fliers and may disperse over long distances if the habitat in which adults emerged becomes unsuitable. Furthermore, the magnitude of migration can differ from year to year—and from day to day within a given year—making it difficult to observe, and documentation of springtime's smaller returning flights is sparse. Identifying the species in a mass flight can also be challenging, as individuals may fly well overhead; a glimpse from below of flashing wings and patterned abdomens may be all an observer has to go by.

Although dragonfly migration has been documented for well over a century, there is still much to be learned about this phenomenon. For example, we lack basic information, such as what environmental cues trigger migratory behavior and where the dragonfly overwintering

grounds are. We don't know details of how the dragonflies migrate: Do individuals that take wing in Canada alight in Mexico or do they routinely join and leave a migratory flight? How do they navigate along the flight path? Nor do we know whether the individuals that overwinter in the south fly north in the spring, or whether migrants mate and lay eggs at suitable habitats along their routes. In some respects we are in a position similar to that of biologists studying monarch butterflies forty years ago. Although we know there is a phenomenon, we know little about it.

In an attempt to answer these and other questions, dragonfly experts, conservationists, and federal agencies have spearheaded the formation of the Migratory Dragonfly Partnership, a collaboration aimed at better understanding and conservation of dragonflies and their migration. In December 2010 a meeting was held in Austin, Texas, to determine the structure of the group and establish its working priorities. Scott Hoffman Black, executive director of the Xerces Society, was named chair of the new partnership, with John Abbott of the University of Texas at Austin as vice-chair. The author and her companions at Cansaburro, Doug Taron and Elisa Peresbarbosa Rojas, are members of the partnership, as are Jim Chu, Carol Lively, and Michael J. Rizo, U.S. Forest Service International Programs; Ralph Grundel, U.S. Geological Survey; Matthew Jeffery, Audubon Society International Alliances Program; Colin Jones, Ontario Ministry of Natural Resources, Canada; Peter Marra and Colin Studds, Smithsonian Conservation Biology Institute; John Matthews, World Wildlife Fund Freshwater Program; Mike May, Rutgers University; and Dennis Paulson, Slater Museum of Natural History, retired.

The goal of the Migratory Dragonfly Partnership is to combine research and

The variegated meadowhawk (*Sympetrum corruptum*) migrates along the Pacific coast in the fall. Photograph by Dennis Paulson.

citizen science with education and outreach to gain better understanding of North America's migrating dragonflies and, in time, to promote conservation of the habitat on which they rely. The partnership will begin by focusing on two major initiatives. The first involves building a network of citizen-scientist monitors across Canada, Mexico, and the United States to track the spring and fall movement of the four most common migratory species in North America: the common green darner, variegated meadowhawk, wandering glider, and black saddlebags. The partnership hopes to develop the tools and resources needed to enable participants to monitor the timing, location, duration, and direction of travel of migratory dragonfly flights, and to identify the species involved. Regular monitoring and centralized reporting via the Odonata Central web site will facilitate identification of changes in species' ranges, increase public awareness of the importance of odonates (dragonflies and damselflies), and enable additional conservation attention to be focused on vulnerable species and habitats.

The second major initiative involves using isotopic signatures (also called isotopic fingerprints) to determine how far a migrating dragonfly has traveled from its point of origin, a technique that has been used in the study of migratory birds. Isotopes are different forms of a chemical element, each with a slightly different atomic structure; these differences vary characteristically with latitude. For dragonflies, an isotopic signature is the ratio between stable isotopes of hydrogen—a component of the water in the wetlands and streams in which the larvae live during development—traces of which remain locked into the wing tissue of the adult following emergence. By comparing the ratio of hydrogen isotopes in its wings to that of the water body where the insect was captured, researchers can estimate how far a dragonfly has moved from its emergence site, measured in degrees of latitude. Such isotopic data will increase our understanding of the points of origin of dragonflies in a mass flight, better delineate southern and northern endpoints of migration, and help distinguish migratory individuals from residents.

North America's migrant dragonflies are not currently rare or endangered, but, with the mystery surrounding migratory cues, pathways, and overwintering grounds, we could put dragonfly migration at risk without detecting it until it was too late. Continuing threats to wetland habitats, coupled with the effects of global climate change, could alter environmental cues for migration, affect the timing of larval development and adult emergence, disrupt migratory corridors, or render overwintering habitat unsuitable. In finding answers to the many questions about dragonfly migration, we will better understand the role of this behavior in the survival of migratory species. This project will also help increase conservation of wetland habitat for all odonates, ubiquitous or rare, ensuring that dragonflies by the millions remain on the wing across North America for years to come.

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