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BIOLOGICAL DIVERSITY: DISCOVERY, SCIENCE, AND MANAGEMENT

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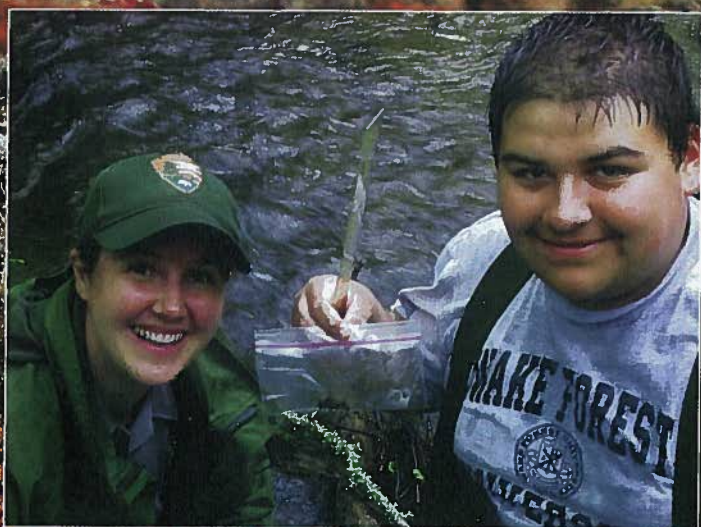
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The GWMP All-Taxa Biodiversity Inventory: Finding new species near the nation's capital

By Brent W. Steury

Figure 1. *Neophylax virginica*, a caddisfly species new to science, was discovered at George Washington Memorial Parkway in 2004.

DR. OLIVER S. FLINT JR. HAD long suspected that a new species of caddisfly lay hidden in one of the many streams emptying into the Potomac River Gorge (fig. 1). It might be found, he reasoned, flitting around the floodplain forests in Turkey Run Park in northern Virginia, not far from the nation's capital. Caddisflies are members of the insect order Trichoptera and have aquatic larvae that often hide in cryptlike protective tubes made of

sand or other stream debris. The adults appear mothlike, with their two pairs of hairy membranous wings and slow flight, as if blowing on a breeze. As curator emeritus of neuropteroids (net-winged insects) in the Department of Entomology at the Smithsonian Institution's National Museum of Natural History, Dr. Flint had described more than 1,000 species of caddisflies from 32 different countries, and he was on the trail of yet another one only a few miles from his office.

The entomologist had been tipped off to the potential presence of this new species when he was reviewing the vast Smithsonian collections and found a single female caddisfly that he could not identify. It had been collected in 1921 by W. L. McAtee of what was then the U.S. Bureau of Biological Survey, now the U.S. Fish and Wildlife Service. The label indicated that the specimen had been taken near "Turkey Run," now protected in Turkey Run Park, a unit

[An estimated] 86% of extant species are still undescribed. . . . Should it be surprising that other smaller forms of life—amphipods, beetles, caddisflies—are being found just outside the nation's capital in an area with one of the highest densities of museums, universities, and research institutions on the planet?

of the George Washington Memorial Parkway.

Coincidentally, around the time Dr. Flint was pondering this unique specimen, parkway staff members were working on their All-Taxa Biodiversity Inventory (ATBI) and contacted him to inquire if he could help with caddisfly identifications. Within a few weeks permits were in place and Dr. Flint and NPS staff found themselves on the bank of Turkey Run on a dark, drizzly October night glaring at a hanging white sheet lit brightly by UV light to attract insects. Of the hundreds of caddisflies attracted to the sheet, a male and four females, plus two males and two females that congregated at lights on the front of the resource management building in Turkey Run Park a few weeks later, proved to be the new species that Dr. Flint later described as *Neophylax virginica* (Flint and Kjer 2011) (fig. 1). Caddisfly collection efforts lasted four years and were expanded to include Great Falls Park a few miles to the north. This work documented 111 species of caddisflies (Flint 2011).

While Dr. Flint was documenting caddisflies, a Smithsonian colleague, Dr. Wayne Mathis, also took an interest in the Potomac River Gorge. Dr. Mathis is a world-renowned expert in shoreflies (Ephydriidae), a family of diminutive flies usually found on beaches and riverbanks. His three-year study found four new species of shoreflies, and a new species of snail-killing fly, in the area near where *Neophylax*

lax virginica was discovered (Mathis et al. 2009; Mathis and Zatwarnicki 2010).

Millions and millions (probably)

Between 1.4 and 1.9 million species of living organisms have been described worldwide (Hamilton et al. 2010; Wilson 1992), and approximately 15,000 new species are added each year (May 2010). Mora et al. (2011) estimated that 86% of extant species are still undescribed and a cottage industry has developed around estimating the number of species on Earth. Erwin (1982) hypothesized that there may be as many as 30 million species of tropical arthropods; Mora et al. (2011) calculated 8.74 million eukaryote species; and May (2010) suggested that a range of 3 to 100 million species is defensible. Undoubtedly, most undescribed species are found in remote tropical latitudes that have long been a draw to biologists enamored with the intricacies, forms, and colors of the diversity of life. Bates (1892) found 700 species of butterflies within an hour's walk of his Brazilian home, while the 76 butterfly species documented from George Washington Memorial Parkway have remained constant since that number was established in 2004. Tropical locations are so diverse that even in urban areas new bird genera are being discovered (Pacheco et al. 1996). Some researchers, such as Hawksworth and Rossman (1997), have recognized urban temperate areas

as being havens for new species within some kingdoms, such as fungi. So should it be surprising that other smaller forms of life—amphipods, beetles, caddisflies—are being found just outside the nation's capital in an area with one of the highest densities of museums, universities, and research institutions on the planet?

Urban biodiversity, look locally

George Washington Memorial Parkway has been conducting its ATBI for 10 years. To date, 4,976 species have been documented, including 58 species new to science, 3 species new to North America, 83 new to Virginia, 7 new to the District of Columbia, and 49 listed as rare by the Natural Heritage Programs of Virginia or Maryland. Since 2004, 50 peer-reviewed journal articles have been published concerning the biodiversity and ecology of the parkway. Highlights of these studies include

- Documenting 1,313 species of vascular plants, including 2 native species new to Virginia and a nonnative species new to North America (Steury 2011; Steury et al. 2008; Steury et al. 2013b)
- 480 species of macro-moths, including 1 species new to Virginia and 11 species state-listed for rarity (Steury et al. 2007)



NPS PHOTO/EMILY ZIVOT

Figure 2. Park Biologist Erik Oberg and Natural Resources Program manager Brent Steury look under a cover board in Turkey Run Park to check for carabid beetles. A nine-year study using eight capture methods documented 184 carabid species from the George Washington Memorial Parkway, including 7 species new to Virginia and 7 species new to the District of Columbia.

- 323 species of beetles in five families, including 3 species new to science, 12 species new to Virginia, and 7 species new to Washington, D.C. (Cavey et al. 2013; Steury et al. 2012; Steury et al. 2013a; Steury and Messer 2014) (fig. 2)
- 55 species of land snails and slugs, including 3 species new to Virginia (Steury and Pearce 2014)
- A crustacean new to science (Holsinger 2009)
- A turtle new to Virginia (Mitchell et al. 2007)
- 91 species of bees from a globally rare plant community type, including 2 species new to Virginia (Steury et al. 2009)

- Three studies of the pollination biology of rare plant species (Barrows et al. 2011, 2012, 2013)
- A 48-hour 2006 bioblitz that documented 19 beetles, 5 true bugs, a fly, a bee, and a copepod new to Virginia (Evans et al. 2008)

Perhaps the greatest challenge now lies not in knowing how many extant species remain unknown, but in finding them before they go extinct. Current extinction rates exceed those of prehuman levels by 100 to 1,000 times (Pimm et al. 1995), and the professional taxonomists needed to describe new species are also becoming rarer (Mora et al. 2011).

George Washington Memorial Parkway will reach the milestone of 5,000 species in 2014. Seven inventory projects are currently under way and four additional projects will be funded through 2018. It is not unreasonable to expect that the parkway will surpass 10,000 species and see an additional 50 journal articles published in the next 10 years. A recent parkway survey of hexapods (collembolans), commonly known as springtails, reported 37 species new to science, but to date, nothing has been published on these finds. Despite continual progress, there is a long way to go to document all taxa at George Washington Memorial Parkway.

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