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Cordulegaster erronea Hagen *in* Selys (Tiger Spiketail) Rediscovered in Michigan (Odonata: Cordulegastridae)

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Abstract

Cordulegaster erronea Hagen *in* Selys (Tiger Spiketail) has been included on the list of Michigan Odonata based on one specimen collected in 1934. In 2016, the species was found in Kalamazoo County, Michigan. It is the least abundant *Cordulegaster* species in Michigan, and the habitat requirements in Michigan are compared with known *C. erronea* habitats in Ohio and New Jersey.

Cordulegaster (Leach, 1815) is a Holarctic genus of medium to large (~55 to 88 mm total length) dragonflies of 34 species worldwide (Schorr and Paulson 2017). The common name in North America for the family, spiketails, refers to the female ovipositor, which is elongated, heavily sclerotized, and looks much like a spike. The typical oviposition behavior is for the female to fly with vertical downward thrusts, inserting the ovipositor into the substrate at the edge of the stream. This behavior has been described as "pogoing," as in one traveling vertically and laterally with a pogo-stick. Each downward thrust into the substrate apparently results in an oviposition.

Nymphs typically inhabit first and second order woodland streams with soft substrates. Nymphs partially bury themselves in the substrate and are well-camouflaged (Dunkle 2000, Glotzhober 2006). Various studies have indicated that nymphs of different *Cordulegaster* species have distinct stream flow, substrate composition, and sediment particle size requirements (Hager et al. 2012 and references within).

Ten species of *Cordulegaster* are found in North America (Paulson and Dunkle 2016), with five confirmed for Michigan: *C. bilineata* (Carle), *C. diastatops* (Selys), *C. erronea* Hagen *in* Selys, *C. maculata* Selys, and *C. obliqua* (Say). Of these five, *C. maculata* is by far the most common and widely distributed species within the state of Michigan (Kormondy 1958, MOS 2017).

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Cordulegaster erronea is found predominantly in the eastern United States; most of the records are from the Appalachian Mountain and mid-Atlantic regions (Abbott 2006-2017). In the Great Lakes area, this species has been reported most frequently in Ohio, where it has been recorded in 14 counties (ten with voucher records, OHC 2017; four with photo or observation records, Rosche et al. 2008) and is listed as a species of special concern (ODNR 2016). Vouchers exist for one county in Illinois (ISM 2006, INHS 2017). It is considered endangered in Indiana (IGA 2014), with one voucher from 1947 (Curry 2001). *C. erronea* has been found at only one site in Ontario, discovered in 2011 (OMNR 2016), and it has not been recorded in Wisconsin (Wisconsin Odonata Survey, 2017).

Spiketails are never "easy" to find, with the exception of *C. maculata*. As of January 2017, the Michigan Odonata Survey Database (MOS 2007-2017) has adult records for 191 *C. maculata*, 32 *C. obliqua*, 9 *C. bilineata*, 29 *C. diastatops*, and 3 *C. erronea*. Nymph and exuviae records are relatively numerous (245+) for *C. maculata,* with only five for *C. obliqua*. Much of the nymph data for *C. maculata* has been the result of incidental bycatch during ichthyological research. *Cordulegaster maculata* has been found in third-order streams, and hence, found in more samples. The other species appear to have preference for small creeks and seepage runs that are much more difficult to find and sample for nymphs.

In Michigan, *C. erronea* Hagen has been an enigmatic species. Kormondy (1958) listed a *C. erronea* record for Marquette County. However, it was based upon Andrews (1929), who listed "possible" species

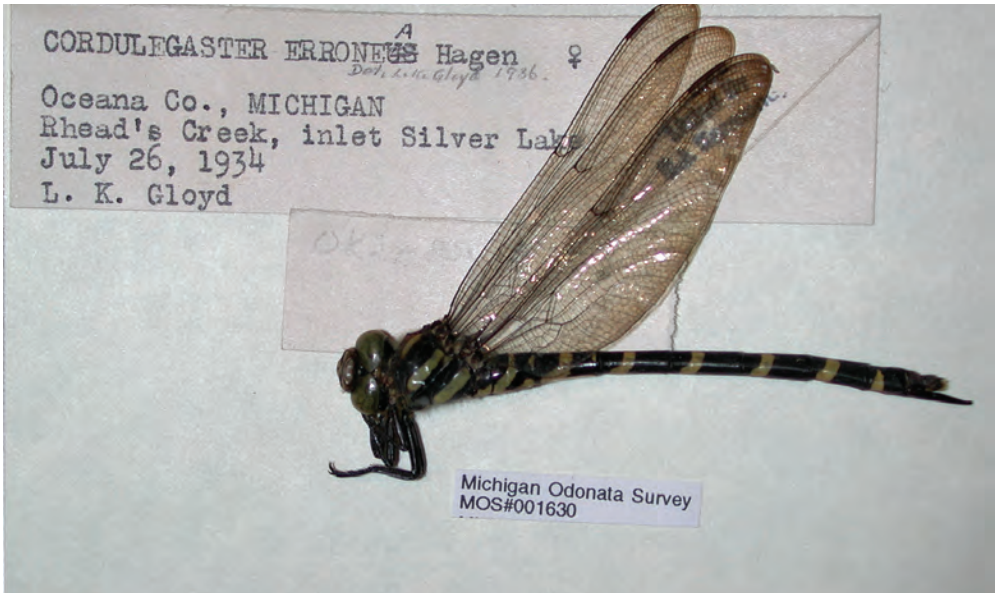

Figure 1. *Cordulegaster erronea*, female specimen collected in 1934.

to be found in the Huron Mountains. That record was refuted in O'Brien et al. (2003). The only other record for the state (Fig.1) was a female collected by Leonora Gloyd on 27 July 1934 from "Rhead's Creek inlet, to Silver Lake," Oceana County, in west-central Michigan, within 3 km of Lake Michigan (MOS001630). Given the source (Van Brink and Kiauta 1977), the veracity of the record was never in doubt but was thought to be

Figure 2. *Cordulegaster erronea* male from Fort Custer Training Center, 3 July 2016.

Figure 3. *Cordulegaster erronea* female from Fort Custer Training Center, 3 July 2016 (released after photo).

anomalous, given that it was far off the known range of the species. Prior to 2016, the nearest records to the Oceana County site were >350 km away (Abbott 2006-2017). Based on this single verified record, it is listed as a species of special concern in Michigan (MNFI 2007).

On 3 July 2016, MFO and DSO were searching for *Tachopteryx thoreyi* (Hagen), Gray Petaltail, at the Fort Custer Training Center, a military base in Kalamazoo and Calhoun counties in southwest Michigan. Mid-morning searches were conducted along a two-track adjacent to numerous seepage areas and small creeks in the Kalamazoo County portion of the base. Several attempts were made to secure spiketails, but they were too high up on branches. Farther down the road, another spiketail was observed hunting in low vegetation in a small clearing above a seepage area. The first netted specimen was a male *C. erronea* 50 m down the roadside (Fig. 2). Based upon the vivid yellow markings, we assume the previously sighted individuals were also *C. erronea*. A few meters farther down the road a second male was captured while it was perched on a small dead shrub ~1 m above the ground. At least two more *C. erronea* individuals were seen. Later, a female *C. erronea* (Fig. 3) was captured, photographed, and released on the hillside above the seeps. According to Dunkle (2000), adults perching on twigs out of reach fits well with our observations.

The habitat of the area surrounding the collection sites was Dry-Mesic Southern Forest above the sandy two-track, with Southern Hardwood Swamp at the base of the hill. Seeps are numerous, and the resulting streams flow into a Southern Wet meadow (Cohen et al. 2009). Paulson (2011) described the habitat for *C. erronea* as "small forest streams and seeps, with skunk cabbage and interrupted fern." In New Jersey, Barlow (1995) reported that this species was found only in very small (<0.3 m wide), forested, perennial cold-water streams free of substantial organic debris with a substrate of fine sand. Glotzhober (2006) studied the life history of *C. erronea* in Ohio, and densely wooded narrow and shallow first-order streams appear to be the preferred nymphal habitat. Of interest is the contrast of these habitats with southern Michigan, where hills are glacial till or old lake dunes, and not bedrock uplands like those in Ohio and New Jersey. Consequently, the flow into Michigan seeps tends to be less consistent, and may be a limiting factor in maintaining populations of seep-inhabiting species.

Groundwater seepages in the area where we found *C. erronea* need further exploration to determine the actual nymph

habitat at Fort Custer. Of concern is the potential effect of any clearing of forest from headwaters where the females oviposit and the subsequent nymphal habitat.

The comprehensive study of *C. erronea* in New Jersey by Moscowitz (2016) provides a great deal of information on the ecology and behavior of this species, which will be useful in searching for additional populations in Michigan and elsewhere.

Voucher specimens reside in the Museum of Zoology, University of Michigan. The 2016 specimen data is as follows: MICHIGAN: Kalamazoo Co., Fort Custer Reserve Training Center, S of Mott Road, along 2-track at wood's edge. 42.2938 x -85.32623, JULY 3, 2016. Mark F. O'Brien, coll. MFO-160703-1, MOS0036933; MICHIGAN: Kalamazoo Co., Fort Custer Reserve Training Center, S of Mott Road, 42.2936 x -85.3264, JULY 3, 2016, Darrin O'Brien, JAC-16-041, MOS0036997.

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