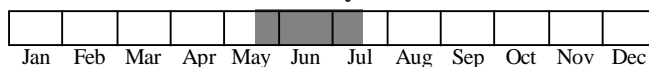


Best Survey Period



Status: State special concern

Global and state rank: G4/S2S3

Family: Gomphidae (clubtail dragonflies)

Range: The splendid clubtail is known only from the eastern United States (NatureServe 2006). The known range of this species extends from Virginia and North Carolina west to Minnesota and Missouri and south to Alabama and Georgia (NatureServe 2006). This species also was historically known from Pennsylvania and Maryland but is currently considered extirpated or possibly extirpated from these two states (NatureServe 2006).

State distribution: Historically, the splendid clubtail has been reported from only nine counties throughout the Lower Peninsula and one county in the Upper Peninsula (i.e., Gogebic County) (Michigan Odonata Survey 2007, Michigan Natural Features Inventory (MNFI) 2007). This species has been documented in several streams and rivers including the Presque Isle River in Gogebic County, the Black River in Cheboygan County, the Chippewa River in Isabella and Midland counties, the Pine River in Gratiot County, Sandstone Creek in Jackson County, and Mill Creek in Washtenaw County. However, the splendid clubtail has not been

reconfirmed in several of the counties from which it had been documented historically since the 1920's, 1930's, and 1940, including Ingham, Midland, Gratiot, and Oakland counties. Systematic surveys for this species have not been conducted throughout the state. Thus, potential exists for this species to still occur at historical sites and at additional sites in which suitable habitat is available.

Recognition: The splendid clubtail is a fairly large dragonfly with **adults averaging 2.6 in** (66 mm, range 2.6-2.7 in/67-69 mm) **long** and wings ranging in length from 1.5-1.8 in (38-45 mm) (Needham and Westfall 1955, Dunkle 2000, Mead 2003). The **thorax** (upper body) is **yellow-green with black shoulders and narrow, midfrontal, parallel, black stripes that are generally not wider than the bordering pale stripes** (Needham and Westfall 1955, Dunkle 2000). The **face is yellow with a narrow, black cross line** (Dunkle 2000, Mead 2003). The eyes are bright green and do not meet at the top of the head. The abdomen (segmented, lower body) ranges in length from 1.8-2.0 in (46-52 mm) (Needham and Westfall 1955). The abdomen is slightly widened at the end, forming a "club," but the **"club" at the end of the abdomen is not as wide as the thorax and is compressed to form vertical sides** (Dunkle 2000, Mead 2003). The abdomen is black with narrow, yellow spots on top up to



segment 7 (Mead 2003). **Segments 8 and 9 towards the end of the abdomen have large yellow spots on the side that reach the front edges of the segments** (Dunkle 2000, Mead 2003). Segments 8 to 10 are usually all black on top, although segment 8 occasionally can have a very small yellow spot on top (Dunkle 2000, Mead 2003). The legs are black. Larvae of the splendid clubtail are flat and brown, and have wedge-shaped heads and short, thick antennae that lie flat on the face (Needham et al. 2000). The larvae also have large, strong hooks at the end of the tibia, or lower leg, for burrowing (Needham and Westfall 1955). The abdomen also has low, flattened dorsal hooks on the top and center of segments 8 and 9, and large, conspicuous lateral spines on the sides of segments 6 to 9 (Needham and Westfall 1955). Splendid clubtail larvae can be distinguished from other species in its genus by the shape of the labium (i.e., chin or 3-lobed lower lip of the jaw) in that the front margin of the median lobe of the labium is deeply concave (Needham and Westfall 1955).

Best survey time: The best time to survey for splendid clubtails is from mid- to late May to mid-July when the larvae leave the water to undergo their final molt and emerge as flying adults (Mead 2003). Adult emergence also can occur earlier in early May and continue into late July, particularly in other parts of the species' range and dependent upon seasonal variations from year to year (Dunkle 2000). Adult emergence in dragonflies typically occurs early in the morning although times can vary among species (Mead 2003). The easiest way to survey for this species is to look for exuviae (shed, cast skin of dragonfly larvae) on rocks, vegetation, woody debris, or other structures along the shore within a few feet of the water's edge or floating on the water's surface. Surveys for aquatic larvae also can be conducted by disturbing the substrate (e.g., kicking the substrate) and dislodging organisms into an aquatic sampling net.

Surveys for adults of this species also can be conducted during or after the emergence period. Since dragonflies require warm conditions for activity and efficient metabolism, they generally are active on warm, sunny days (i.e., air temperature of 65°F or higher), but become less active and seek cover on cool, cloudy days (Dunkle 2000, Mead 2003). They also are less active and seek cover on hot, sunny days to avoid overheating

(Mead 2003). Adult dragonflies, in general, also tend to be most active during late morning and early to mid-afternoon (Dunkle 2000, Mead 2003).

Habitat: The splendid clubtail inhabits clean, fast-flowing, large to medium-sized streams and rivers with good water quality and rocky substrates with gravel, sand, and silt (Dunkle 2000, Mead 2003). Larval clubtails, in general, require well-oxygenated water, which restricts most species to clean, fast-flowing streams and rivers (Mead 2003). In Michigan, splendid clubtail larvae have been found in large to medium-sized streams and rivers (estimated 40-200 ft/12-61 m wide and 0.25-6+ ft/0.1-1.8+ m deep) with substrates consisting of boulders, cobbles, gravel, sand, and silt (MNFI 2007). This species also has been found in a small stream (16-30 ft/5-9 m wide) with sand and silt substrates. Water temperatures at these sites ranged from 66-72°F (19-22°C) (MNFI 2007). Vegetation along the banks at these sites ranged from 35-90% forested to a mowed lawn with some shrubs at one site (MNFI 2007).

Biology: The splendid clubtail exhibits a typical dragonfly life cycle with an aquatic egg, aquatic larva or nymph, and a terrestrial/aerial adult. Little information has been published about the life history of the splendid clubtail. Their eggs are usually laid in moving water (Mead 2003). The eggs are carried by the water and are deposited in interstitial spaces in the rock, gravel, and/or sand substrate of the stream or river. The time required for the eggs to develop and hatch is not known for the splendid clubtail, but dragonfly eggs generally hatch in about 10 days to as long as several months (Dunkle 2000).

As with most dragonflies, the splendid clubtail likely spends most of its life as an aquatic larva (Mead 2003). After the eggs hatch, gomphid or clubtail larvae generally burrow shallowly into the substrate where they grow and develop (Needham et al. 2000). As the larvae grow, they shed or molt their skin numerous times. The shed skin is referred to as exuviae. Clubtail larvae are likely opportunistic, ambush predators that burrow and hide in the substrate and pounce on prey when they come within striking distance (Mead 2003). Dragonfly larvae, in general, feed mainly on other aquatic insects, such as the larvae of mosquitoes, mayflies, stoneflies, water beetles, daphnia, and other



dragonfly larvae (Silsby 2001, Mead 2003). Larger dragonfly larvae may even prey on tadpoles and small fish (Mead 2003). Pygmy snaketail (*Ophiogomphus howei*) larvae have been reported to feed on water mites, mayfly nymphs, and chironomids or midges (Kennedy and White 1979). Other burrowing clubtail larvae have been reported to feed mainly on midges and other non-odonate insects (Gibbs et al. 2004). In turn, dragonfly larvae are preyed upon by fish, birds, aquatic insects, and other dragonfly larvae (Mead 2003).

The time required for splendid clubtail larvae to develop into adults is not specifically known. Most dragonfly species transform into adults in one to three years (Mead 2003), and clubtails generally transform in two or more years (Dunkle 2000). Splendid clubtails likely overwinter as larvae, as with all dragonflies in northern forests (Mead 2003).

When the larvae are ready to transform into adults, they climb out of the water and attach themselves to vegetation, rocks, woody debris, bare ground, or other structures or surfaces along the stream banks or floating in the water (Mead 2003). The larvae undergo a final molt and emerge as winged adults. Emergence typically occurs from mid- to late May to mid- to late July (Dunkle 2000, Mead 2003). Newly emerged adults, or teneral, typically remain perched for one or two hours to dry their wings before they can fly (Mead 2003). During this time, they are extremely vulnerable to predation and mortality due to human disturbance or environmental factors such as wind or rain (Dunkle 2000, Mead 2003).

Although the lifespan of an adult splendid clubtail is not specifically known, adult dragonflies typically live for approximately one to two months, and up to nine months to a year in a few species (Dunkle 2000). Adult dragonflies become sexually mature within a week or up to a month after emergence (Dunkle 2000). Males usually initiate mating by grasping females with their legs and terminal appendages (Mead 2003). The connected pair then mates on the ground or low plants or in trees (Mead 2003). Splendid clubtails primarily perch and forage from the ground or herbaceous vegetation along the shore (Dunkle 2000). Since they are heavy-bodied, they tend to fly and hover over water only when temperature conditions are right (Dunkle 2000). Adult dragonflies forage on live insects, including butterflies, moths, damselflies, mosquitoes, and flies

(Mead 2003). Predators of adult dragonflies include birds, frogs, lizards, fish, and other large dragonflies (Mead 2003).

Conservation/management: Given that the splendid clubtail has been documented from only a small number of sites in Michigan, all known populations of this species should be protected and monitored. Maintaining good water quality and gravelly or sandy substrates is essential for conservation of this species. Clubtail dragonflies, in general, require clean, well-oxygenated water, and are highly sensitive to changes in water quality (Mead 2003). Dams, stream channel modifications, shoreline modifications, pollution, sedimentation, and other practices that reduce water quality can cause habitat loss and degradation and can adversely impact this species (Smith 1999). These activities or threats should be avoided or minimized at sites at which this species occurs. Maintaining largely forested watersheds and forested streamside buffers also would benefit this species.

Research needs: A systematic survey for splendid clubtails is needed to identify additional occupied sites and determine this species' status and distribution in Michigan. Additional surveys and monitoring of known sites are warranted to determine their population status, extent, and viability. Research is needed to obtain more information about the splendid clubtail's life history, including its phenology, larval development, and specific larval and adult habitat use and requirements in Michigan. An assessment of threats to the species also should be conducted. Additional information on the species' status, distribution, life history, and threats will facilitate the development of appropriate conservation and management strategies for this species in Michigan.

Related abstracts: rapids clubtail (dragonfly), extra-striped snaketail (dragonfly), pygmy snaketail (dragonfly), incurvate emerald (dragonfly), Hine's emerald (dragonfly)

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