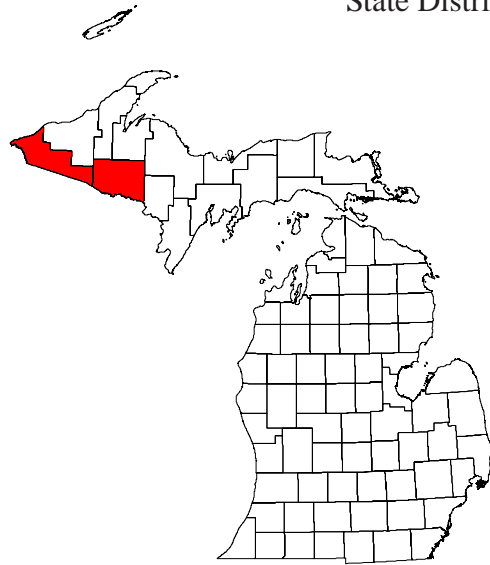
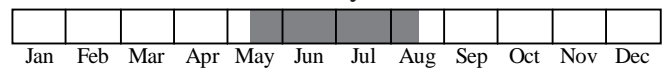




State Distribution



Best Survey Period



Status: State special concern

Global and state rank: G3/S1

Family: Gomphidae (clubtail dragonflies)

Range: The extra-striped snaketail is known only from northeastern North America (NatureServe 2006). The known range of this species extends from New Brunswick west through southern Quebec and Ontario to Wisconsin and Minnesota and south along the Atlantic Seaboard through Maine, Vermont, New York, and Pennsylvania to the Delaware River in New Jersey (Dunkle 2000, NatureServe 2006). This species is uncommon and has very localized distributions throughout its range (Dunkle 2000, NatureServe 2006).

State distribution: The extra-striped snaketail has been documented from only two counties in the western Upper Peninsula in Michigan (i.e., Iron and Gogebic) (Michigan Natural Features Inventory (MNFI) 2007). This species has been found in the Paint, Presque Isle, and Black rivers in these counties. However, systematic surveys for this species have not been conducted throughout the state. Thus, potential exists for this species to occur in additional counties in which suitable habitat is available.

Recognition: The extra-striped snaketail is a medium-sized dragonfly with adults measuring about 1.5-1.7 inches (39-44 mm) in total length, with the abdomen about 1.1-1.3 in (28-33 mm) long and the hind wing about 0.9-1.1 in (24-27 mm) long (Smith 1999). The **thorax** (upper body) is **bright green with black lateral stripes that form an uninterrupted N-shaped marking on the side of the thorax** just above the leg bases (Dunkle 2000, Mead 2003, NatureServe 2006). The **face is green with narrow, black cross lines or stripes** (Dunkle 2000, Mead 2003, NatureServe 2006). The eyes are green and do not meet at the top of the head. The occiput (top part of the head) also is green with black along the outer edges that continues to form a black ridge behind the eyes (Smith 1999). The **abdomen** (segmented, lower body) is **slightly widened at the end** (“clubtail”), and is **black with long, yellow bands or spots on top that reduce to round spots toward the end of the abdomen (segments 9 and 10)** (Mead 2003). The legs are black.

Larvae of the extra-striped snaketail are flat, brown, and have divergent wing cases (NatureServe 2006). Extra-striped snaketail larvae can be distinguished from other dragonfly larvae by the shape of the larval antennae (Smith 1999, NatureServe 2006). The **last**



segment of the larval antennae (segment 4) is nearly as wide as segment three, appearing as a continuation of segment three, and is **broad, smooth, and rounded or cap-like at the end** (Needham and Westfall 1955, Smith 1999).

Best survey time: The best time to survey for extra-striped snaketails in Michigan is from mid- to late May through early August when the larvae leave the water to undergo their final molt and emerge as flying adults (Dunkle 2000, Mead 2003). Emergence typically occurs between 0600 and 1400 hours (Gibbs et al. 2004). 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 adult extra-striped snaketails also can be conducted during or after the emergence period although they are generally difficult to observe because they tend to spend most of their time in treetops high above the water (Dunkle 2000, Mead 2003). Adults tend to be most active during late morning and early to mid-afternoon (Dunkle 2000, Mead 2003). Also, because 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).

Habitat: The extra-striped snaketail inhabits very high quality, clear, fast-flowing, large to medium-sized streams and rivers with gravel, sand, or cobble substrates in largely forested watersheds (Smith 1995, Smith 1999, Dunkle 2000, NatureServe 2006). Water depth is usually less than one meter (NatureServe 2006). *Ophiogomphus* or snaketail larvae, in general, require clean, well-oxygenated water and gravel or sand substrates with little sedimentation (Smith 1995, Smith 1999, Mead 2003). Snaketail larvae generally are not found in streams or rivers with reduced currents, high levels of sedimentation, or in watersheds that are less than one-half to two-thirds forested (Smith 1999). In Michigan, extra-striped snaketail larvae have been

found in large to medium-sized streams and rivers (estimated 70-200 ft/21-61 m wide and 2-6 ft/0.6-1.8 m deep) with substrates consisting of boulders, cobbles, gravel, sand, and some silt (MNFI 2007). Water temperatures at these sites ranged from 60-70°F (16-21°C) (MNFI 2007). Vegetation along the banks at these sites ranged from largely forested (70-90% forested) to largely herbaceous (70-80% herbaceous) with some trees and shrubs (MNFI 2007). Smith (1999) states that extra-striped snaketails in Wisconsin prefer fast-flowing, medium-sized, warm water streams (100-800 ft/30-244 m wide) with abundant gravel and excellent water quality in heavily forested watersheds.

Biology: The extra-striped snaketail exhibits a typical dragonfly life cycle with an aquatic egg, aquatic larva or nymph, and a terrestrial/aerial adult. Little information has been published specifically about the life cycle of the extra-striped snaketail. Female snaketails, in general, lay their eggs in riffles or rapids in streams and rivers by dipping their abdomen in the moving water (Mead 2003, NatureServe 2006). 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. Dragonfly eggs generally hatch in about 10 days to as long as several months (Dunkle 2000).

As with most dragonflies, the extra-striped snaketail likely spends most of its life as an aquatic larva (Mead 2003). After the eggs hatch, the aquatic larvae burrow shallowly in sandy or gravelly river bottoms where they grow and develop (Mead 2003). As the larvae grow, they shed or molt their skin numerous times. The shed skin is referred to as exuviae. The 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 mosquito larvae, daphnia, and other dragonfly larvae (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 dragonfly larvae have been reported to feed mainly on chironomids 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 extra-striped snaketail larvae to develop into adults is currently not known. Snaketails generally transform in two or three years (Smith 1999). Gibbs et al. (2004) found a variety of larval stages or instars from May to October during a study in Maine, including final instar larvae in July after emergence of adults in June. These results suggest that the extra-striped snaketail has overlapping generations and produces more than one brood or generation per year (Gibbs et al. 2004). These results also indicate that the extra-striped snaketail may require two or more years to complete a generation since some larvae remained in the final instar for almost a year before emerging as adults (Gibbs et al. 2004). These results also indicate that extra-striped snaketails overwinter as larvae.

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 located along the stream banks or floating in the water (Mead 2003). The larvae then undergo a final molt and emerge as winged adults. Emergence typically occurs from late May or early June to early August (Dunkle 2000, Mead 2003, NatureServe 2006). 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).

Adult extra-striped snaketails tend to spend most of their time in treetops high above the water and rarely perch low or on rocks (Dunkle 2000, Mead 2003). Adults of this species are occasionally found on bushes near the tree line along stream riffles (Smith 1999, Dunkle 2000). Adult snaketails, in general, also can be difficult to see when perched on vegetation or flying over moving water because of their green color and their wings tend to reflect sunlight over the water (Dunkle 2000, Mead 2003).

Although the lifespan of adult extra-striped snaketails is not specifically known, adult dragonflies typically live for approximately one or two months, and up to nine months to a year in a few species (Dunkle 2000, Silsby 2001). Adult dragonflies become sexually mature within a week or up to a month after emergence (Smith 1999, Dunkle 2000). Males usually initiate mating by grasping

females with their legs and terminal appendages (Mead 2003). The connected pair then flies to nearby bushes and trees to mate (Smith 1999, Mead 2003). Extra-striped snaketails forage for flying insects, such as butterflies, moths, damselflies, mosquitoes, and flies, in bushes and trees (Smith 1999, Mead 2003, NatureServe 2006). Predators of adult dragonflies include birds, frogs, lizards, fish, and other large dragonflies (Mead 2003).

Conservation/management: Given that the extra-striped snaketail 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 with little sedimentation is essential for conservation of the pygmy snaketail. Snaketail dragonflies, in general, require clean, well-oxygenated water, and are highly sensitive to changes in water quality (Smith 1999). They also appear to be limited in distribution by the types of substrates in which the larvae can survive (Smith 1999). Also, the larvae burrow in sand but are vulnerable to being buried in silt or washed away during spring snowmelt or other significant increases in water flow (Mead 2003). Dams, stream channel modifications, shoreline modifications, pollution, and sedimentation can cause habitat loss and degradation and can adversely impact the 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 extra-striped snaketails in all suitable habitat in the state 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. More information on the extra-striped snaketail's life history, including its phenology, larval development, and specific larval and adult habitat use and requirements in Michigan, should be obtained. An assessment of threats to the species at extant sites also should be conducted. Additional information on the species' status, distribution, life history, and threats will facilitate development of appropriate conservation and management strategies for this species in Michigan.



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

Selected references

- Dunkle, S. W. 2000. Dragonflies through binoculars: A field guide to dragonflies of North America. Oxford University Press, New York.
- Gibbs, K. E., B. Bradeen, and D. Boland. 2004. Spatial and temporal segregation among six species of coexisting *Ophiogomphus* (Odonata: Gomphidae) in the Aroostook River, Maine. *Northeastern Naturalist* 11:295-312.
- Kennedy, J. H. and H. B. White III. 1979. Description of the nymph of *Ophiogomphus howei* (Odononata: Gomphidae). *Proceedings of the Entomological Society of Washington* 81:64-69.
- Mead, K. 2003. Dragonflies of the North Woods. Kollath-Stensaas Publishing, Minnesota.
- Michigan Natural Features Inventory (MNFI). 2007. Biotics database. Lansing, Michigan.
- NatureServe. 2006. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.1 NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed: January 22, 2007).
- Needham, J. G. and M. J. Westfall, Jr. 1955. A manual of the dragonflies of North America (Anisoptera). University of California Press, Berkeley, California.
- Needham, J. G., M. J. Westfall, Jr., and M. L. May. 2000. Dragonflies of North America. Scientific Publications, Gainesville, Florida.
- Silsby, J. 2001. Dragonflies of the world. Smithsonian Institution Press, Washington, D. C.
- Smith, W. A. 1995. Status and distribution of *Ophiogomphus* dragonflies in Wisconsin. Report to the U.S. Fish and Wildlife Service, Office of Endangered Species for Cooperative Agreement No. 14-16-003-89-933. Natural Heritage Inventory Program, Bureau of Endangered Resources, Wisconsin Department of Natural Resources, Madison, Wisconsin.
- Smith, W. A. 1999. The endangered and threatened invertebrates of Wisconsin. Pub-ER-085-99. Bureau of Endangered Resources, Wisconsin Department of Natural Resources, Madison, Wisconsin.

Abstract citation

- Lee, Y. 2007. Special animal abstract for *Ophiogomphus anomalus* (extra-striped snaketail). Michigan Natural Features Inventory. Lansing, MI. 4 pp.

Copyright 2007 Michigan State University Board of Trustees.

Michigan State University Extension is an affirmative-action, equal-opportunity organization.

Funding for abstract provided by the Michigan Department of Transportation.

