

Species: Rapids Clubtail (*Gomphus quadricolor*)

Global Rank: G3G4

State Rank: S1S2

State Wildlife Action Plan: Immediate Concern Species

Climate Change Vulnerability: Highly Vulnerable

Confidence: Very High

#### Habitat:

In Pennsylvania the Rapids Clubtail dragonfly is most commonly associated with swift medium to large stream and rivers. *Gomphus quadricolor* prefers habitats with small rapids or riffles intermixed with quiet muddy pools. Adult males prefer in-stream boulders and bedrock outcrops for perching. Young adults can be found far from their stream of origin as they feed and mature prior to returning to stream habitats to breed. Larvae develop in muddy pools below shallow rapids, and utilize dense emergent streamside vegetation for emergence. More surveys are needed to determine the range and microhabitat preferences for this species in Pennsylvania.

#### Threats:

The most significant threats to the Rapids Clubtail are: alteration and destruction of habitat from impoundments, dredging, channelization, sedimentation, and other alterations of stream channels; water quality degradation from urbanization, acid mine drainage, agriculture, pesticides and other chemicals; spread of invasive aquatic species; fragmentation of forests around headwater streams; loss of riparian forest; direct mortality from vehicle collisions where roads intersect habitat.

#### Main factors Contributing to Vulnerability Rank:

Climate change vulnerability for the Rapids Clubtail is linked to factors expected to impact water quality and hydrology. These factors are expected to be important for many other clubtail dragonflies (family Gomphidae) of good quality stream and river habitats. Regions of Pennsylvania where *Gomphus quadricolor* occurs have experienced slightly lower than average precipitation variation in the past 50 years, making populations somewhat vulnerable to future changes in precipitation. Pennsylvania is expected to have higher winter and spring stream flows, but lower summer and fall flows. Changes in the timing of peak spring flows, higher temperatures and lower flows in the summer and fall, and changes in stream channels due to more severe precipitation and flooding events are expected to negatively impact aquatic ecosystems (Shortle et al. 2009). Even though *Gomphus quadricolor* does not require highly specialized or limited habitats, shifts in the hydrologic regime could be problematic. Larvae utilize specific microhabitats within a stream as they develop over two or more years, and appear to be sensitive to landscape-scale changes in land use that affect water temperature and quality (COSEWIC 2008). A mitigating factor is the ability of adults to disperse relatively easily along stream corridors to colonize new habitats.

Other global climate change related threats include: construction of dams on medium to large rivers for hydroelectricity, flood control, or water storage; natural gas extraction and its associated impacts on forest integrity and water quality; warmer air temperatures and reduced watershed forest cover leading to increased water temperatures and lower dissolved oxygen levels; facilitated spread of invasive aquatic species due to milder winters and warmer waters.

Some of the current and projected threats could be mitigated with removal of dams where they are not critical to energy production, water storage, or protection of infrastructure. Protection and expansion of riparian buffers around medium to large streams and rivers is critical. Increasing percent forest cover in occupied watersheds and their headwaters could be used towards carbon offsets while improving water quality for this species. Long term monitoring of water quality and hydrologic regime on occupied reaches of streams could provide important insight into habitat requirements and limits, combined with information on population stability or decline.

Migration and Movements: This species does not exhibit migratory behavior, and does not like to stray far from water. The maximum known dispersal inland is approximately 800 m (COSEWIC 2008). However it is a relatively strong flier capable of dispersing several kilometers in a day along river corridors. River currents can also carry eggs or young larvae downstream, potentially dispersing them to suitable unoccupied habitat.

#### Literature Cited:

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