

**Species Listing PROPOSAL Form:**  
**Listing Endangered, Threatened, and Special Concern Species in Massachusetts**

Scientific name: *Gomphus vastus*Current Listed Status (if any): Special ConcernCommon name: Cobra Clubtail**Proposed Action:**☐ Add the species, with the status of: \_\_\_\_\_☒ Remove the species☐ Change the species' status to: \_\_\_\_\_

Change the scientific name to: \_\_\_\_\_

Change the common name to: \_\_\_\_\_

(Please justify proposed name change.)

**Proponent's Name and Address:**

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Association, Institution or Business represented by proponent: [Natural Heritage & Endangered Species Program,](#)  
[Massachusetts Division of Fisheries & Wildlife](#)

Proponent's Signature:

Date Submitted:



2/26/2018

Please submit to: Natural Heritage & Endangered Species Program, Massachusetts Division of Fisheries & Wildlife, 1 Rabbit Hill Road, Westborough, MA 01581

**Justification**

Justify the proposed change in legal status of the species by addressing each of the criteria below, as listed in the Massachusetts Endangered Species Act (MGL c. 131A) and its implementing regulations (321 CMR 10.00), and provide literature citations or other documentation wherever possible. Expand onto additional pages as needed but make sure you address all of the questions below. The burden of proof is on the proponent for a listing, delisting, or status change.

(1) **Taxonomic status.** Is the species a valid taxonomic entity? Please cite scientific literature.

Yes, *Gomphus vastus*, Walsh 1863 (Paulson & Dunkle 2009) or *Gomphurus vastus* (Needham et al. 2000). The latter synonym is a reclassification of the genus, which was never changed under MESA.

(2) **Recentness of records.** How recently has the species been conclusively documented within Massachusetts?

There are three EO's of *G. vastus* in Massachusetts and presence has been documented in all three EO's since 2013.

(3) **Native species status.** Is the species indigenous to Massachusetts?

Yes, the species is considered native to Massachusetts.

(4) **Habitat in Massachusetts.** Is a population of the species supported by habitat within the state of Massachusetts?

Yes, 10,891 acres of species habitat are mapped in Massachusetts for the three EO's, along the Connecticut, Deerfield, and Merrimack Rivers following current MA NHESP Species habitat mapping guidelines.

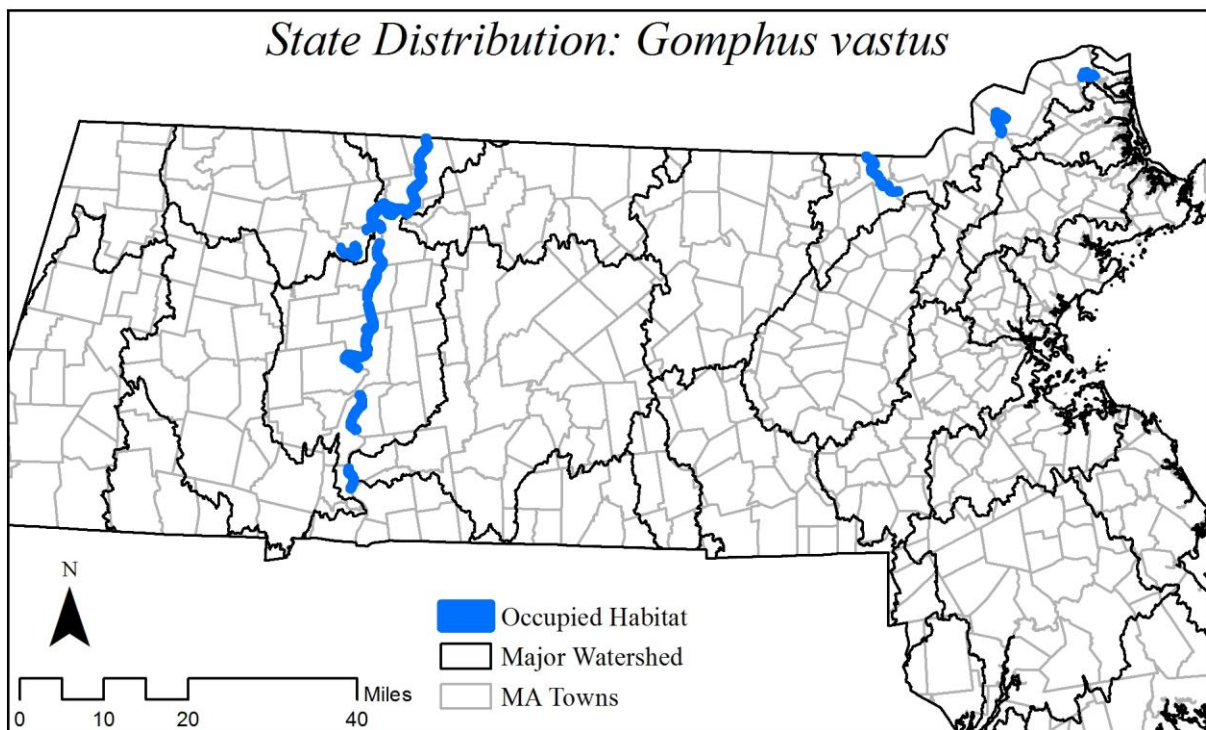
(5) **Federal Endangered Species Act status.** Is the species listed under the federal Endangered Species Act? If so, what is its federal status (Endangered or Threatened)

No, Species is not listed under USESA.

**(6) Rarity and geographic distribution.**

(a) Does the species have a small number of occurrences (populations) and/or small size of populations in the state? Are there potentially undocumented occurrences in the state, and if so, is it possible to estimate the potential number of undocumented occurrences?

The species is represented by three populations (Element Occurrences, or EO's) within the Commonwealth, including the lower Deerfield River, main-stem Connecticut River, and main-stem Merrimack River (Figure 1). The lower Deerfield River location is only 3.5 km from the Connecticut River population, and likely a sub-population of the latter. Only one observation of a single exuviae was made during a single year in the Deerfield River, thus this population may not be a viable population, but dispersing animals from the Connecticut River population. *Gomphus vastus* is considered a large river specialist throughout most of its range (Hunt et al. 2010), and the Merrimack and Connecticut Rivers likely represent the only habitats available in the Commonwealth. Nevertheless, the population in the Connecticut River is robust and *G. vastus* has been found along the majority of the length of the river in the Commonwealth. It is likely that reaches of the Connecticut River outside of currently mapped habitat are also occupied by *G. vastus*, and a lack of data from those reaches may reflect a lack of sampling rather than a lack of occurrence. Further, the farthest downstream section of the Connecticut River is also likely occupied as *G. vastus* does occupy the river south of the state line in Connecticut.

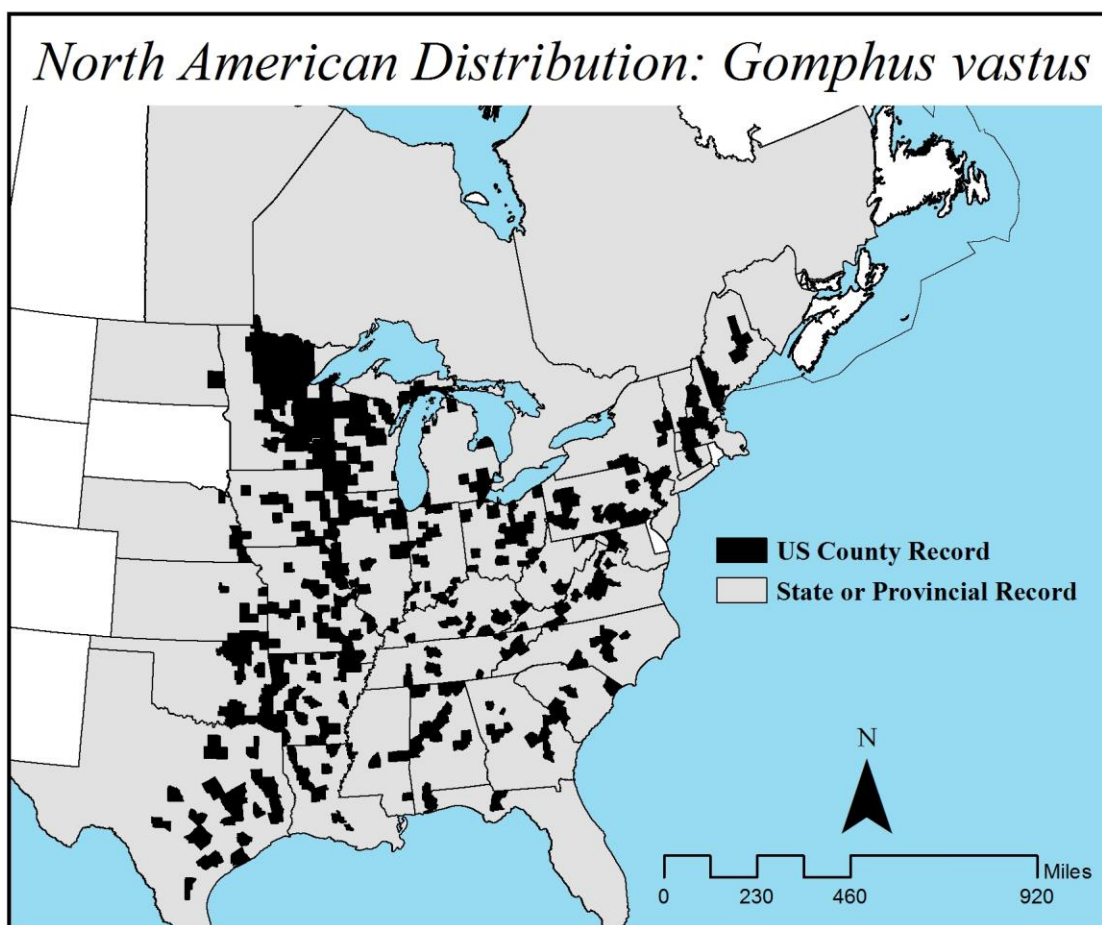


**Figure 1: Distribution of *Gomphus vastus* in Massachusetts.** Occupied Habitat reflects NHESP mapped Species Habitat.

(b) What is the extent of the species' entire geographic range, and where within this range are Massachusetts populations (center or edge of range, or peripherally isolated)? Is the species a state or regional endemic?

*Gomphus vastus* is native, but not endemic to the northeastern United States. In North America, it is present from four Canadian Provinces and 34 US States, from as far south as Florida and Texas; north to Manitoba, Quebec and New Brunswick (Figure 2). The species is known from every US

State east of the Mississippi River, with the exception of Delaware and Rhode Island, both of which lack significant large river habitats. Massachusetts is not at the edge of the range of the species, but also does not appear to be regionally important as a stronghold within the species range. Massachusetts has very little regional or global responsibility for this species' conservation.



**Figure 2: Distribution of *Gomphus vastus* in Canadian Provinces and US States and Counties.** Data from OdonataCentral (Abbot 2008-2018). Provincial region and county scale data was not available.

**(7) Trends.**

(c) Is the species decreasing (or increasing) in state distribution, number of occurrences, and/or population size? What is the reproductive status of populations? Is reproductive capacity naturally low? Has any long-term trend in these factors been documented?

There are no long-term discernable trends in population size or occupancy rates. However, NHESP sampling methods may not target such data as no long-term monitoring framework has been created. Currently NHESP has 64 observations (i.e., Sources) of the species in the NHESP database, and approximately 94% of these observations have occurred since the species was first listed under MESA in 1993 (Figure 3). *Gomphus vastus* was listed under MESA prior to the development and adoption of a formal listing criteria document by NHESP in 2008 (NHESP 2008), and presumption of rarity made at the time of listing were likely the result of data deficiency at that time. The 2008 listing criteria have since addressed the listing of species that are data deficient, and it is unlikely that this species would be considered by the program if a listing proposal was made today.

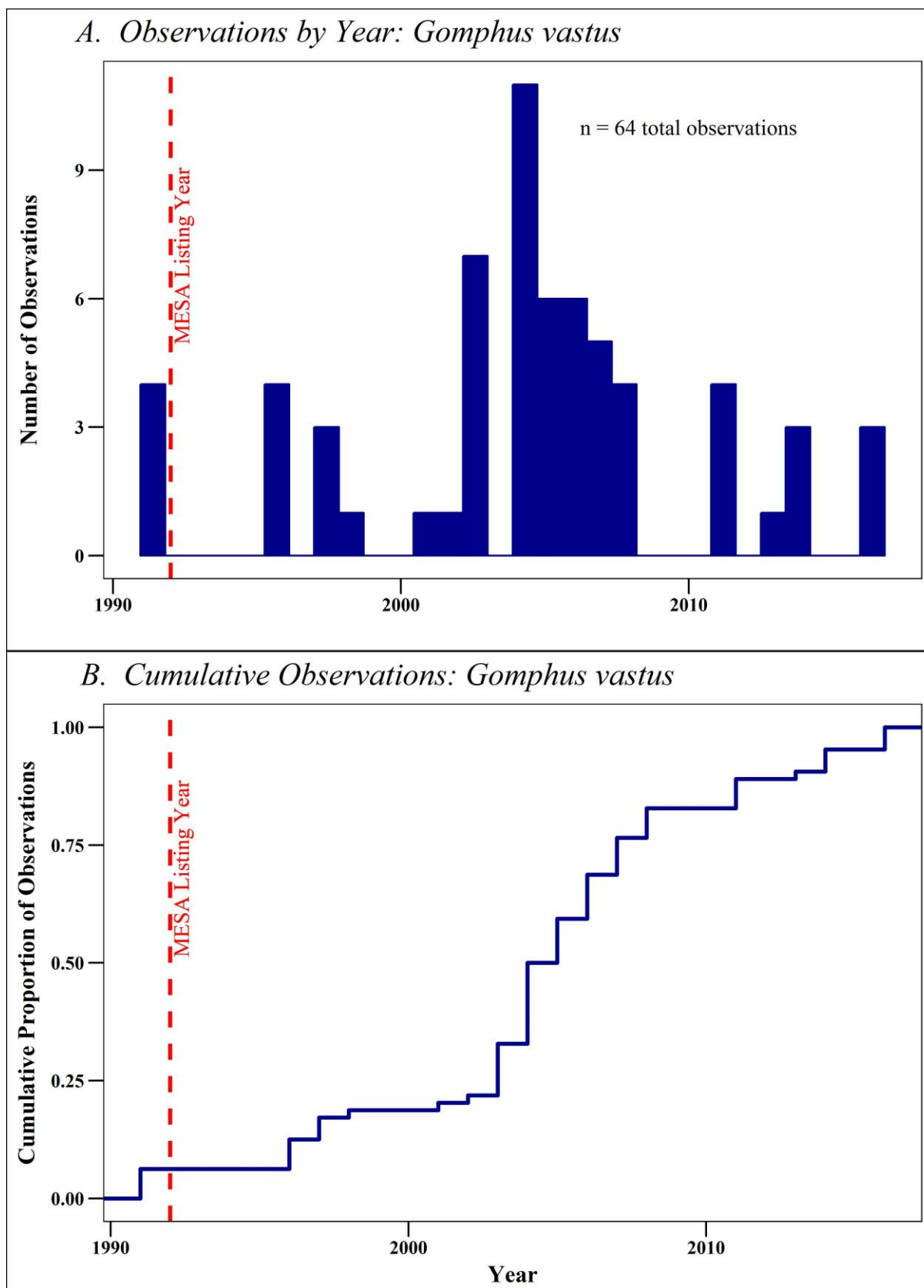
An increasing trend in the number of observations since listing has been observed in Massachusetts (Figure 3B). This is likely driven by an increase in survey effort. Nevertheless, White et al. (2014) found that relative change in range of *Gomphus vastus* to be slightly declining, but this was fairly insignificant and among the smallest range changes calculated of all Odonates native to the Northeast States (VA-ME). Further, *G. vastus* was found to be in the lowest category of habitat vulnerability in the Northeast States, as well as the lowest level of regional responsibility as only ~18% of the species range occurs in the Northeast (White et al. 2014, 2015).

In 2015 *Gomphus vastus* was assigned a Global Rank of “Secure” (G5), and “Apparently Secure” Nationally (N4- NatureServe 2017). Massachusetts NHESP evaluated and updated the State Rank based on all current data in fall 2017 using the *NatureServe Conservation Status Assessments: Rank Calculator* (v.3.186). State Rank was updated to S3 (“Vulnerable”) from a 2011 assignment as S2S3 (“Imperiled/Vulnerable”).

Populations in both rivers are known to be reproducing, evidenced by the presence of adult, larval and exuviae records from the Connecticut and Merrimack Rivers. Repeated surveys in the Connecticut River above-and-below the Turners Falls Dam suggest that *G. vastus* is among the most abundant species in the river when surveys are timed appropriately with emergence. Between 2002-2008 abundance of emerging odonates were tracked at bank stabilization sites in the Connecticut River (above Barton Cove). The mean abundance following bank stabilization efforts was 375 exuviae/100 linear ft. of bank – an order of magnitude greater than the next most abundant species, *Macromia illinoiensis*, which is not MESA listed (McLain 2008).

Within the same area of the Connecticut River (Gill, MA), Martin (2009) surveyed 50 plots (18.58 m<sup>2</sup>) each upstream and downstream of the Northfield Mountain Pumped Storage Intake/Outflow (42.611754 N, -72.478289 W). Of the seven species she tracked, she found *G. vastus* to be the second most common with an average density of 0.21/m<sup>2</sup>. Over 500 *G. vastus* exuviae were found across all of the plots – more than double of any other species surveyed (Martin 2009).

From 2014-2016 exuviae surveys were conducted in sites above and below the Turners Falls Dam in Montague, MA as part of the Federal Energy Regulatory Commission (FERC) project relicensing process (Biodrawiversity 2017). In that study, 348 *G. vastus* were observed between 2015 and 2016, accounting for ~45% of all exuviae from 18 species observed in the study, and was three times greater than the next most abundant species – *Epitheca princeps*.



**Figure 3. Total Observations (A) and Cumulative Observations (B) Through Time for *Gomphus vastus* in the NHESP Database.** Only the first year of a given Source feature is included. Red dashed line represents year *G.vastus* was listed under MESA.



**(8) Threats and vulnerability.**

(d) What factors are driving a decreasing trend, or threatening reproductive status in the state? Please identify and describe any of the following threats, if present: habitat loss or degradation; predators, parasites, or competitors; species-targeted taking of individual organisms or disruption of breeding activity.

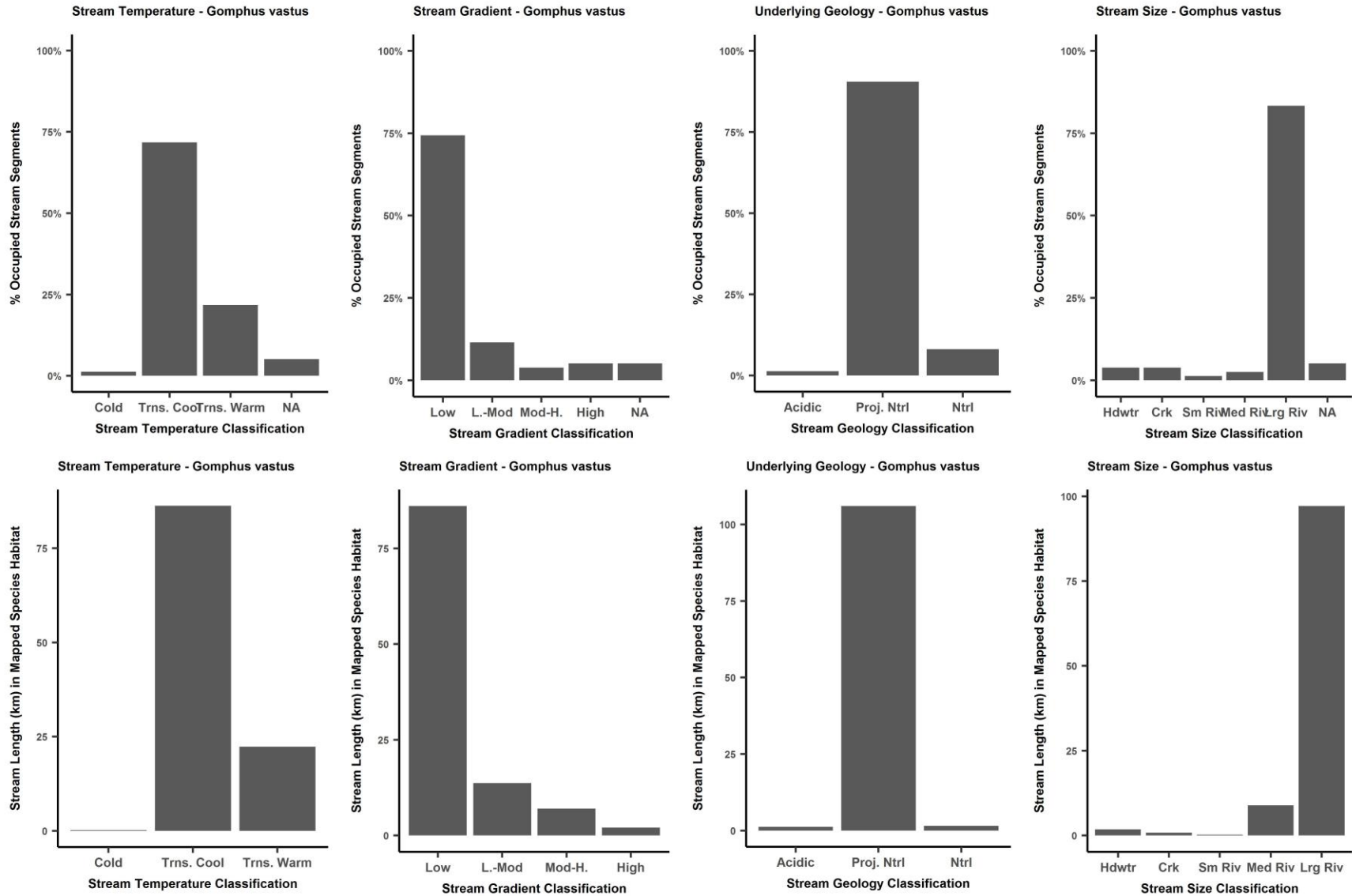
A threat assessment was conducted by NHESP as part of the Conservation Rank Assessment in 2017. Identified threats include: hydroelectric energy generation (peaking) in the Connecticut River, and industrial, agricultural, and domestic wastewater effluent as the primary threats to *G. vastus* in both the Connecticut and Merrimack Rivers. However, the impacts of these threats were assessed relatively low because current data on the distribution and abundance of *G. vastus* shows little effect of these threats.

Effects of hydroelectric operations on emerging dragonflies were recently evaluated during the Turners Falls Dam FERC relicensing process. Surveys conducted as part of this study found not only that *G. vastus* was among the most abundant species found in the surveys, but also that the species occurred in the majority of sites downstream of the dam (Biodrawversity 2017). *Gomphus vastus* was only absent from three sites, all of which were within the Barton's Cove area of the impoundment, where the habitat is more lacustrine. Combined with data from earlier studies (McLain et al. 2008, Martin 2009), where *G. vastus* was found in segments of the river upstream of Barton's Cove, there is little evidence that *G. vastus* habitat is limited in the Connecticut River as a result of hydropower operations. Further, *G. vastus* was among the few species found at the Rock Dam site within the bypass reach, which is likely among the most degraded sites in the river due to large changes in water surface elevation, and often minimal flows caused by peaking.

NHESP required FirstLight Power (current owner of Turners Falls Dam) to conduct a risk analysis of the effects of changing water surface elevations on emerging dragonflies as part of the relicensing study. Emerging *Gomphus vastus* had higher mean climb heights (7.4 ft above water level) and distances (17.1 ft from water's edge) than most other species studied. These higher climb heights are largely protective of most emerging/eclosing *G. vastus* within the project area, and current peaking operations are only likely to affect *G. vastus* eclosure rates within the bypass area (Biodrawversity 2017).

Martin (2009) also evaluated emergence/eclosure distance of *G. vastus* within sites upstream of Barton's Cove. She found that *G. vastus* traveled ~ 3-4 m, on average, from the water's edge to eclose making it one of the farthest traveling species, and less likely to be affected by changes in water surface elevation. She also evaluated the effect of bank stabilization materials on emergence rates, and found no statistically significant trend in the number of exuviae in streambanks that were naturally eroding compared to those that had been stabilized with rip-rap. However, animals eclosing on rip-rap had a climbing distance of 2 m shorter than those eclosing on natural substrates.

There is also no apparent effect of developed areas on *G. vastus* distribution, and it has been observed within the highly developed areas of the Connecticut River in West Springfield/Chicopee, as well as the cities of Methuen and Haverhill on the Merrimack River. Biodrawversity conducted a study in 2013, to evaluate the relative abundance of dragonfly nymphs in urban and rural areas of the Connecticut River in Massachusetts (Biodrawversity 2013). Among 285 quadrats between 19 study sites, only two *G. vastus* nymphs were recorded from rural sites, and four were recorded from urban sites, representing only 2% of the total nymphs of all species. Of the nine species found in the study, only three species had more than 10 individuals total, and samples were dominated by *Stylurus spiniceps* (n=80 in rural sites, and 179 in urban sites).



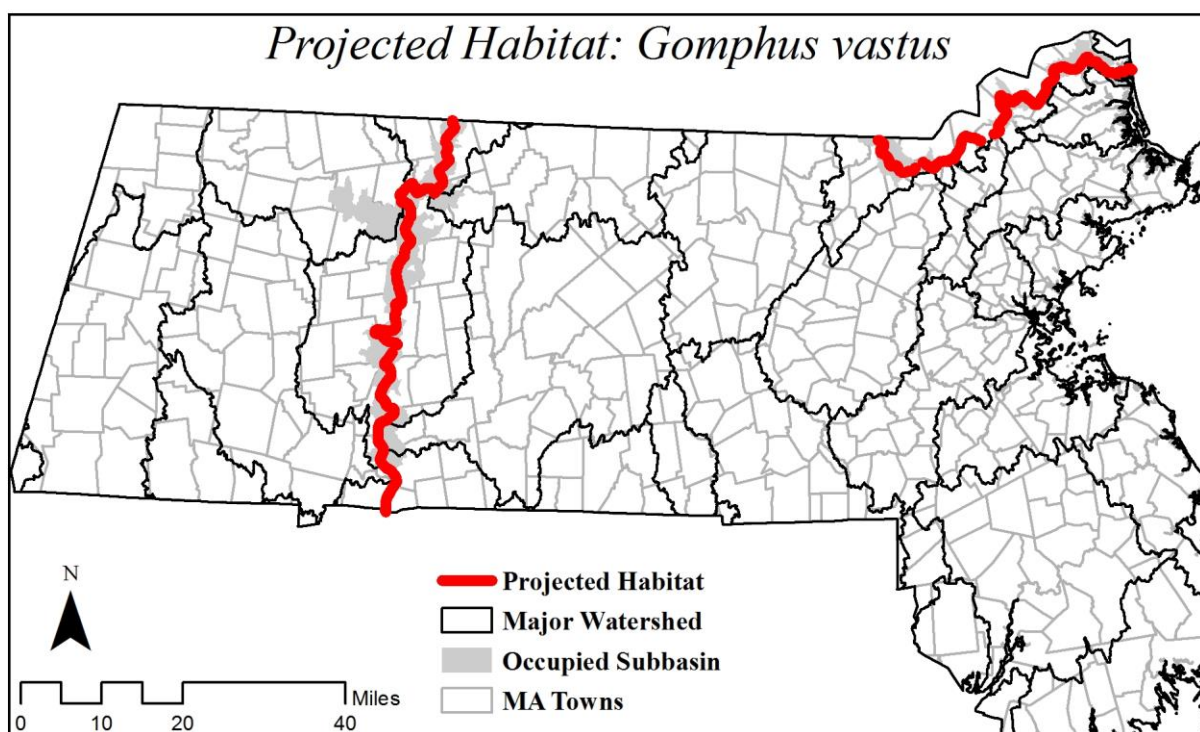
**Figure 4: The Nature Conservancy Northeast Stream Habitat Classifications Occupied by *Gomphus vastus*.** Percent of stream segments within *G. vastus* Species Habitat (upper panel), and kilometers of occupied stream length within each classification (lower panel), arranged from left to right: Stream Temperature, Gradient, Underlying Geology and Size classification.



(e) Does the species have highly specialized habitat, resource needs, or other ecological requirements? Is dispersal ability poor?

*Gomphus vastus* is reported to be a large river specialist throughout much of its range (Hunt et al. 2010). I used The Nature Conservancy's Northeast stream classification dataset (Anderson et al. 2013) to evaluate habitat use by *G. vastus* in Massachusetts by intersecting NHESP mapped Species Habitat with TNC stream habitat categories including: Temperature, Gradient, Underlying Geology, and Stream Size (Figure 4). The proportion of occupied segments (% Occupied Stream Segments) likely overestimates the value of smaller streams as many smaller segments may overlap with species habitat – drawn as the water body where a record was found with a 200m buffer. However, the length of occupied streams is more realistic to the habitat occupied by *G. vastus* in Massachusetts.

I calculated the total available habitat of *G. vastus* by selecting river segments of the TNC stream classification dataset that corresponded to Large Rivers with Low Gradient based on the prevalence of these habitats within mapped *G. vastus* Species Habitat. The majority of the Connecticut and Merrimack Rivers were selected as potential habitat, and summed to 179 river km of habitat available in Massachusetts (Figure 5). Currently, mapped Species Habitat accounts for 95.1 km (56%) of the available habitat for *G. vastus* in the Commonwealth, though this may be an underestimate as the predicted habitat includes the entirety of the Merrimack River below the tidal and brackish influence. Nevertheless, NHESP currently has occurrence data supporting that the majority of *G. vastus* habitat in the state is occupied by the species, and this rate would likely increase with further sampling effort.



**Figure 5: Projected Habitat for *Gomphus vastus* in Massachusetts.** Habitat was projected based on TNC stream habitat classification system (see Anderson et al. 2013) for Large Rivers with Low Gradient Classifications, chosen from prevalence of this habitat within mapped *Gomphus vastus* Species Habitat.

## **Conservation goals.**

What specific conservation goals should be met in order to change the conservation status or to remove the species from the state list? Please address goals for any or all of the following:

NHESP does not recommend further conservation goals are needed prior to delisting. NHESP will continue to track occurrences of this species through dragonfly exuviae surveys targeting sympatric MESA listed species.

(a) State distribution, number of occurrences (populations), population levels, and/or reproductive rates

- Currently there are two major populations within the Commonwealth including the Connecticut River and Merrimack River populations.
- This species is among the most abundant observed in three independent exuviae studies in the Connecticut River, all incorporating significant sampling efforts.
- Annual reproductive rates may vary significantly for this species, as they often will for asynchronous semivoltine insects (i.e., animals take more than 1 year to mature, and have overlapping generations).

(b) Amount of protected habitat and/or number of protected occurrences

Currently, 10,892 acres of Species Habitat are mapped for *G. vastus* in the Commonwealth, 5,837 acres of which are upland habitat (excluding open water). Approximately 27% of this upland habitat is protected in perpetuity as either State, municipal or other conservation land.

Rates of land protection required for conservation of aquatic species are difficult to identify as the entire watershed upstream of the population should be considered as influencing the aquatic habitat. Approximately 18% of upland within all subbasins occupied by *G. vastus* is currently protected. Continued protection of the watersheds in the Connecticut River basin should be targeted based on sympatric MESA listed species, and will further aid in long term conservation of *G. vastus* – but this species alone should not be targeted for land protection above other MESA listed species.

(c) Management of protected habitat and/or occurrences

Approximately 80% of *G. vastus* habitat in Massachusetts overlaps with Regulatory Habitat (including Priority and Estimated Habitat) of other species listed under MESA, including other listed dragonflies. Priority and Estimated Habitat allow environmental regulatory review of projects which may affect the conservation of MESA listed species. This considerable overlap will aid in the conservation of *G. vastus* habitat as conservation outcomes of regulatory review will likely be focused on conserving habitat for sympatric aquatic species.

**Literature cited:**

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**Additional documentation, and comments.**