

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

Scientific name: *Neurocordulia yamaskanensis*Current Listed Status (if any): Special ConcernCommon name: Stygian Shadowdragon**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:

Peter Hazelton

Aquatic Ecologist

Natural Heritage & Endangered Species Program

Massachusetts Division of Fisheries & Wildlife

1 Rabbit Hill Road, Westborough, MA 01581

Phone Number: 508-389-6389

E-mail: peter.hazelton@state.ma.us

Fax: 508-389-7890

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, *Neurocordulia yamaskanensis* – Provancher, 1875 (Paulson & Dunkle, 2009).

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

There are current 9 populations (Element Occurrences, or EOs) in the Commonwealth, all of which have been observed since 2003, some as recently as 2016. There are no historic populations within NHESP's database.

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

The species is native, but not endemic to Massachusetts.

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

Yes, currently NHESP has delineated 15,331 acres of Species Habitat in the Commonwealth following current 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, the species is not currently listed under US ESA.

(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 nine extant populations from six major watersheds from central Massachusetts west through Berkshire County, including the Housatonic, Westfield, Deerfield, Millers, Connecticut Mainstem and Chicopee Watersheds (Figure 1). Although there are gaps in the mapped distribution along the Connecticut River, it is likely that the Connecticut River, and lower portions of the Westfield, Deerfield, Millers and Mill River (North Hampton) may represent one continuous population.

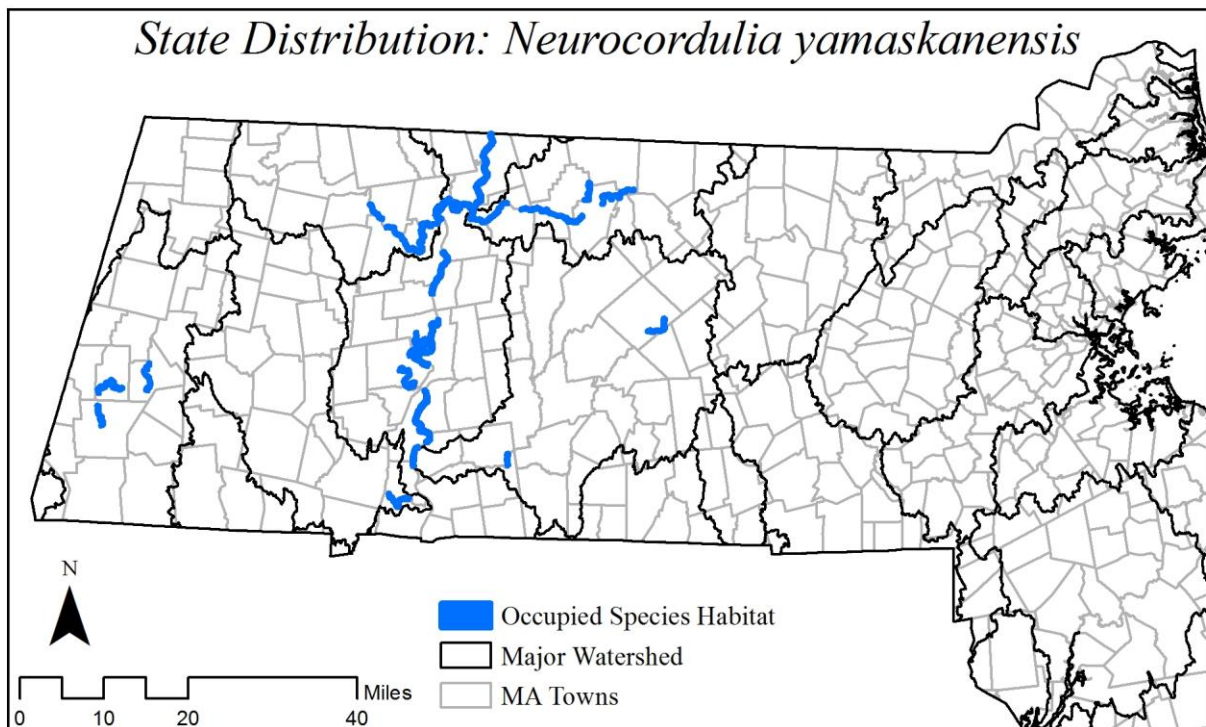


Figure 1: Distribution of *Neurocordulia yamaskanensis* in Massachusetts. Occupied Habitat reflects NHESP Mapped Species Habitat.

(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?

Neurocordulia yamaskanensis is native, but not endemic to the northeastern United States. In North America, it is present from as far west and south as Arkansas and Mississippi, north to Manitoba and east to Quebec and New Brunswick (Figure 2). Two high concentrations of county records occur in the northwestern (Minnesota, Wisconsin & Upper Peninsula Michigan) and northeastern (NY & New England) portions of the species range in the U.S. A significant responsibility of the species range lies within the Northeastern States (White et al. 2014; 2015).

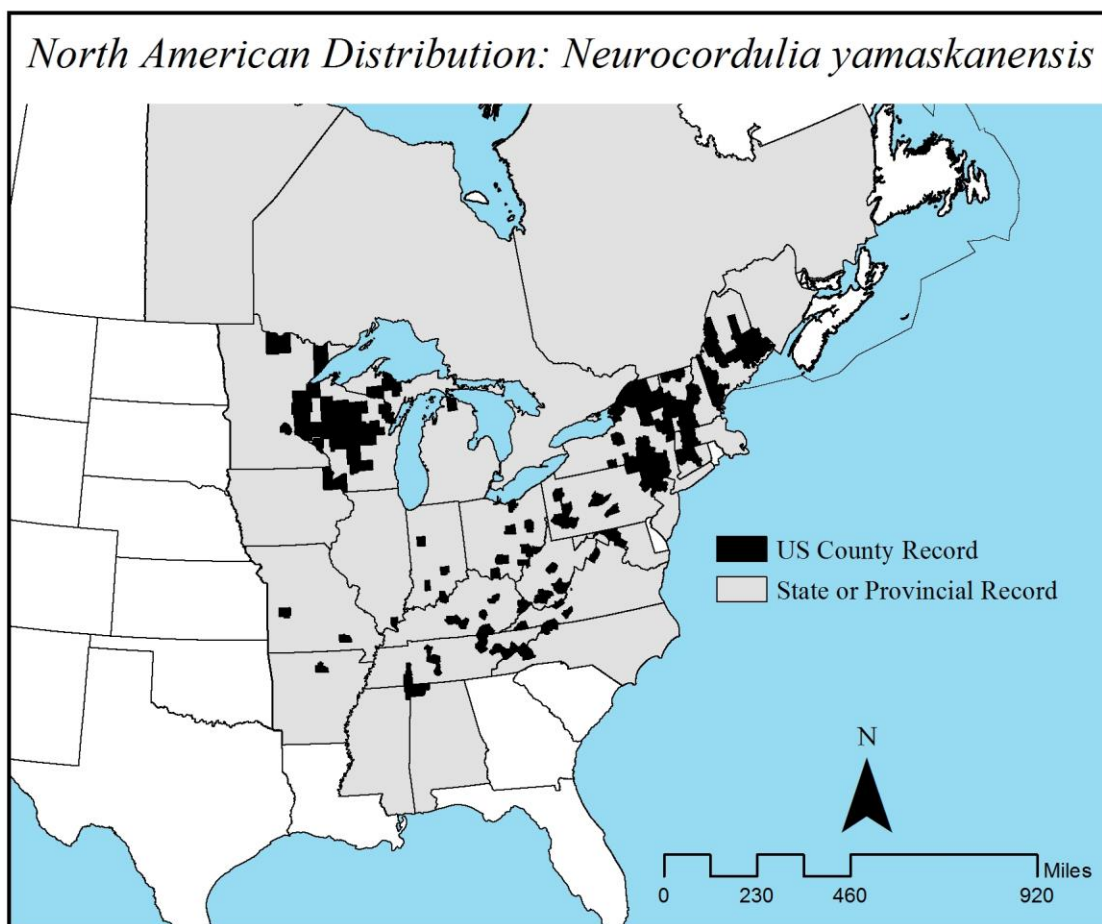


Figure 2: Distribution of *Neurocordulia yamaskanensis* in Canadian Provinces and US States and Counties. Data from OdonataCentral (Abbot 2008-2018). Provincial region and county scale data was not available.

(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 developed for Odonates. *Neurocordulia yamaskanensis* was first observed in Massachusetts in 1996, and was listed under MESA in 2003 because of presumed rarity reflected by only three observations. However, at the time, the majority of Odonate records in NHESP's database were from adult specimens. Species in the genus *Neurocordulia* are thought to be crepuscular, which may have contributed to a lack of appropriate sampling and presumed rarity. Incorporation of exuvial surveys and greater confidence in identification between *N. obsoleta* and *N. yamaskanensis* has allowed further data collection and confidence in distribution. Greater than 93% of the observations in Massachusetts have occurred after the species was listed (Figure 3).

During an evaluation of all Odonates native to the northeastern US states (VA-ME), White et al. 2014; 2015) found an increase in the relative size of the range occupied by the species when comparing records pre-post 2000, suggesting a potential lack of sampling range wide prior to 2000.

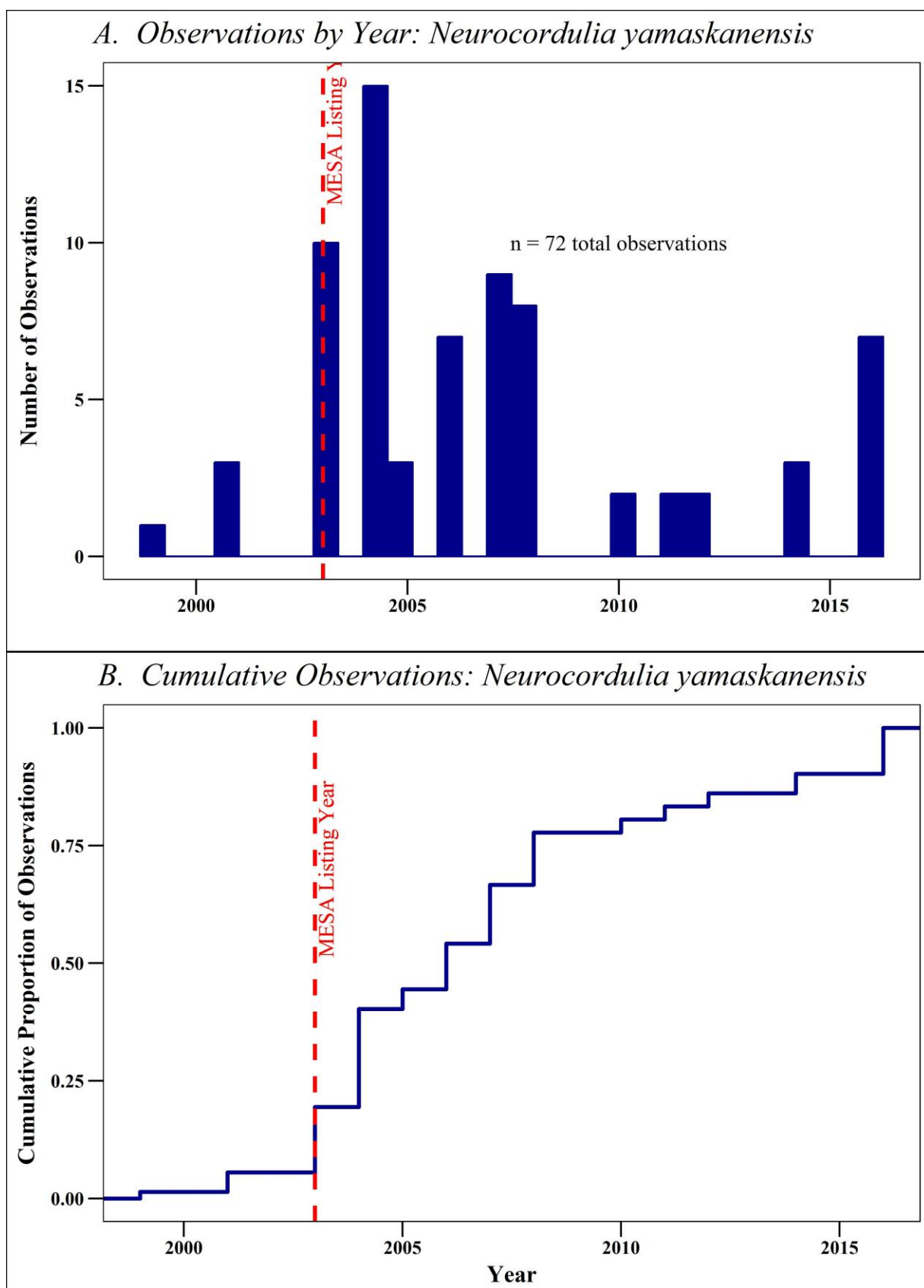


Figure 3: Total Observations (A) and Cumulative Observations (B) through time for *Neurocordulia yamaskanensis* in the NHESP database. Only the first year of a given Source feature is included. Red dashed line represents year *N. yamaskanensis* was listed under MESA.

NatureServe currently ranks *N. yamaskanensis* as globally “Secure” (G5) and nationally secure in the U.S. (N5) and Canada (N4N5- NatureServe 2017). State rank was re-evaluated in 2017 as “Vulnerable” with some uncertainty (S3?), and did not change markedly from the evaluation in 2011 (S3).

The majority of populations are known to be reproducing, evidenced by the presence of adult, and exuvial records. Repeated surveys in the Connecticut River above-and-below the Turners Falls Dam suggest that *N. yamaskanensis* is among the most often recorded 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 17 exuviae/100 linear ft. of bank (McLain 2008).

Within the same area of the Connecticut River (Gill, MA), Martin (2009) surveyed 50 plots (18.58 m²) each upstream and downstream of the Northfield Mountain Pumped Storage Intake/Outflow (42.611754 N, -72.478289 W). She found no statistically significant difference in habitats surveyed, or eclosure surfaces, and a mean density of 0.036 *N. yamaskanensis* per m² of survey area, or 3-4 eclosing animals per 100m² of survey area.

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, 23 *N. yamaskanensis* were observed between in 2015, and the species was found at all sites surveyed in 2014 and 2015, including sites up and downstream of the dam and within the impounded lacustrine habitat of Barton’s Cove.

(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 threats assessment was conducted by NHESP in 2017 using the *NatureServe Conservation Status Assessments: Rank Calculator* (v.3.186). Identified threats included: hydroelectric energy generation (peaking) in the Deerfield and Connecticut Rivers, as well as industrial, domestic, and agricultural run-off and effluents. However, the impacts of these threats were assessed as relatively low because current data on the distribution of *N. yamaskanensis* 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 *N. yamaskanensis* collected from the majority of sites, but that the occupied sites included those with significantly altered habitat (Biodrawiversity 2017). *Neurocordulia yamaskanensis* was present from three sites 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 *N. yamaskanensis* was found in segments of the river upstream of Barton’s Cove, there is little evidence that *N. yamaskanensis* habitat is limited in the Connecticut River as a result of hydropower operations. Further, *N. yamaskanensis* 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 hydropeaking (i.e., fluctuation of water levels during hydropower generation).

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 *N. yamaskanensis* had higher mean climb heights (6.6 ft above water level) and distances (13.2 ft from water's edge) than many of the other species studied. These higher climb heights are largely protective of most emerging/eclosing *N. yamaskanensis* within the project area. Fewer than 20% of emerging individuals are at risk of water surface elevation changes outside of the bypass area, where 50% or more may be at risk; however, this area represents only a small proportion of the occupied habitat within the areas surveyed (Biodrawiversity 2017).

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

Neurocordulia yamaskanensis occurs within lakes and ponds, as well as medium to large rivers with high to moderate gradients, and these habitats were considered among the least rare or vulnerable in an assessment of all odonates and habitats in the northeastern states (White et al., 2015). In Massachusetts, *N. yamaskanensis* is often found in impounded riverine sections, as well as tailraces below dams. Similar observations have been made in the Connecticut River in Vermont and New Hampshire, where the species was the most common in the impounded sections above Wilder, Bellows Falls and Vernon Dams (Hunt et al. 2010).

I used The Nature Conservancy's Northeast stream classification dataset (Anderson et al. 2013) to evaluate habitat use by *N. yamaskanensis* 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 *N. yamaskanensis* in Massachusetts. From this analysis, it appears that *N. yamaskanensis* is predominantly found in cool, medium to large rivers with low-moderately high gradients.

Habitats most often occupied in Massachusetts were used to assess the projected available habitat in the Commonwealth (Figure 5). Species habitat of some extant EOs were not highlighted in the projected habitat because these EOs occurred in Small Rivers (e.g., Mill River Northampton at the Oxbow, an impoundment of the Ware River in Barre, and the East Branch of the Tully River in Athol), or because the temperature classification of that segment was Transitional Warm (e.g., lower Westfield River, and the impoundment below Red Bridge State Park on the Chicopee River). Despite these areas, the known distribution of *N. yamaskanensis* in Massachusetts (Figure 1) overlaps markedly with the projected habitat (Figure 5). Further survey effort in the Housatonic, Westfield and Deerfield Rivers may yield a larger distribution of the species in the State.

Little data exist on the dispersal distances of *N. yamaskanensis*, but it does not appear that the species is dispersal limited, and most of the habitat within the Commonwealth is continuous along major rivers. Species distribution modelling to assess the effects of climate change on 15 lotic Odonates in the northeast (Collins, 2014; Collins & McIntyre, 2017) projected that *N. yamaskanensis* was among the species least affected by nearly all of the climate scenarios, and that suitable climate refugia exist for the species in the northeast.

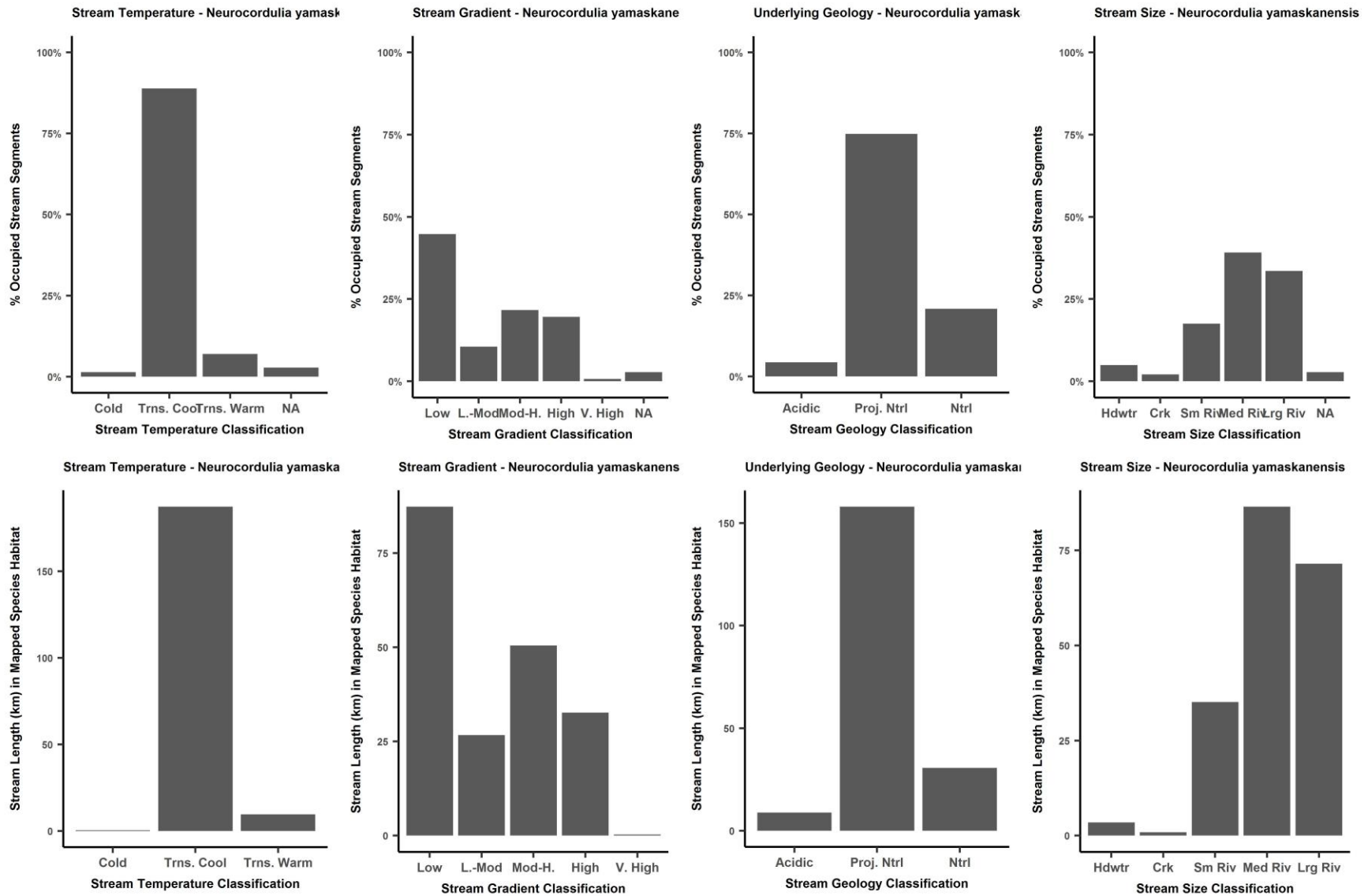


Figure 4: The Nature Conservancy Northeast Stream Habitat Classifications Occupied by *Neurocordulia yamaskanensis*. Percent of stream segments within *G. vastus* Species Habitat (upper panel), and kilometers of occupied stream length within each classification (lower panel), arranged from left to right: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

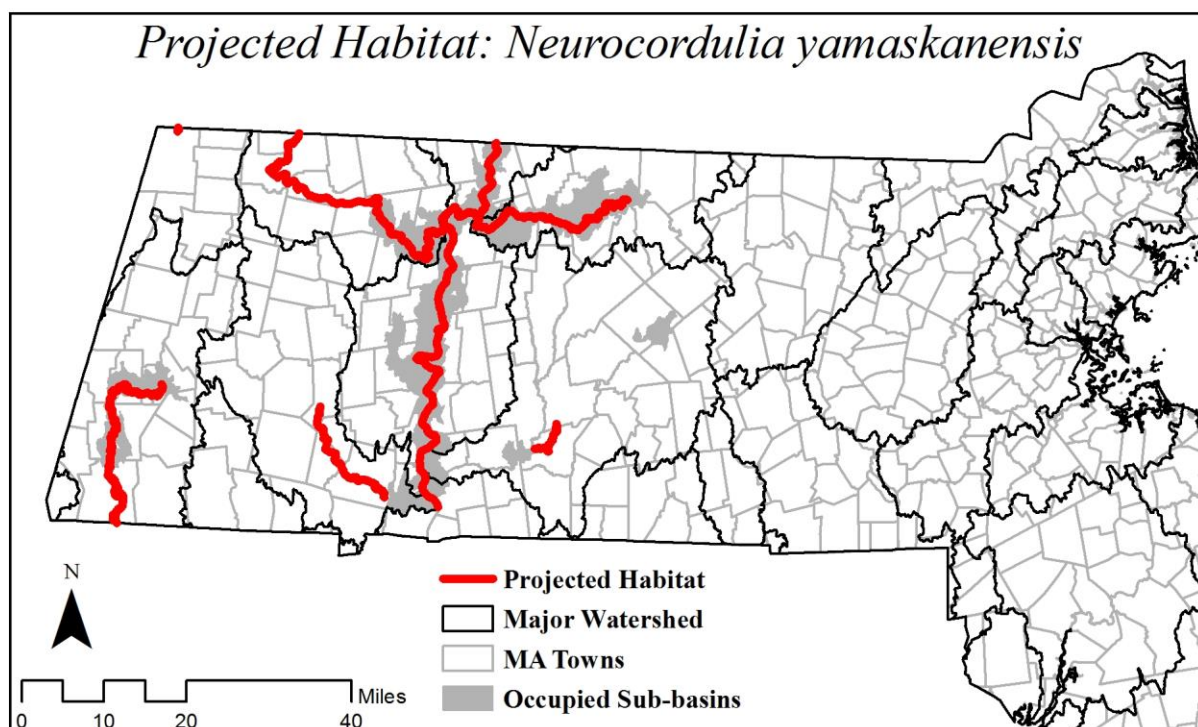


Figure 5: Projected Habitat for *Neurocordulia yamaskanensis* in Massachusetts. Habitat was projected based on TNC stream habitat classification system (see Anderson et al. 2013) for Cool, Medium-Large Rivers with Low-High Gradient, and Neutral/Projected Neutral underlying Geology.

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 nine extant populations in the Commonwealth.

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

Approximately 15,300 acres are mapped in Massachusetts as Species Habitat for *N. yamaskanensis*, and approximately 9,200 of those acres are upland habitat (i.e., excludes open water). As much as 26% of this upland habitat is protected as conservation land, in perpetuity, by the State, municipality or land trusts.

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 24% of the upland habitat within the sub-basins occupied by *N. yamaskanensis* is currently protected. Continued protection of the watersheds occupied by *N. yamaskanensis* may

further aid in longterm conservation of the species in Massachusetts – 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 73% of *N. yamaskanensis* Species Habitat mapped 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 that may affect the conservation of MESA listed species. This considerable overlap will aid in the conservation of *N. yamaskanensis* habitat as conservation outcomes of regulatory review will likely be focused on conserving habitat for sympatric aquatic species.

Literature cited, additional documentation, and comments.

- Abbott, J.C. 2006-2018. OdonataCentral: An online resource for the distribution and identification of Odonata. Available at . (Accessed: January 17, 2018).
- Biodrawversity. (2017). *Relicensing Study 3.3.10 Assess Operational Impacts on Emergence of State-Listed Odonates in the Connecticut River 2014-2016 Study Report*.
- Collins, S. D. (2014). *Fine-Scale Modeling of Riverine Odonata Distributions in the Northeastern United States*. Ph.D. Dissertation. Texas Tech University. Retrieved from <https://ttu-ir.tdl.org/ttu-ir/bitstream/handle/2346/58956/COLLINS-DISSERTATION-2014.pdf?sequence=1>
- Collins, S., & McIntyre, N. E. (2017). Extreme loss of diversity of riverine dragonflies in the northeastern U . S . is predicted in the face of climate change U . S . is predicted in the face of climate change. *Bulletin of American Odonatology*, 12(2), 7–19.
- Hunt, P. D., Blust, M., & Morrison, F. (2010). Lotic Odonata of the Connecticut River in New Hampshire and Vermont. *Northeastern Naturalist*, 17(2), 175–188. <https://doi.org/10.1656/045.017.0201>
- Martin, K. H. (2009). *The Transition Zone: Impact of Riverbanks on Emergent Dragonfly Nymphs Implications for Riverbank Restoration and Management*. Ph.D. Dissertation. Antioch University New England. Retrieved from https://etd.ohiolink.edu/rws_etd/document/get/antioch1268590285/inline
- McLain, D. 2008. Dragonfly population dynamics and bank stabilization in the Turners Falls Pool of the Connecticut River: results of the 2008 field season. Unpublished report to New England Environmental, Inc., and Energy Capital Partners.
- NatureServe. 2017. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available <http://explorer.natureserve.org>. (Accessed: January 31, 2018).
- Paulson, D. R., & Dunkle, S. W. (2009). *A Checklist of North American Odonata: Including English Name, Etymology, Type Locality, and Distribution* (2009th ed.). Seattle, WA: Jim Johnson. Retrieved from https://www.odonatacentral.org/docs/NA_Odonata_Checklist_2009.pdf
- White, E. L., Hunt, P. D., Schlesinger, M. D., & Corser, J. D. (2014). *A Conservation Status Assessment of Odonata for the Northeastern United States*. Albany, NY.

White, E. L., Hunt, P. D., Schlesinger, M. D., Corser, J. D., & Phillip, G. (2015). Prioritizing Odonata for conservation action in the northeastern USA. *Freshwater Science*, 34(June), 1079–1093.
<https://doi.org/10.1086/682287>.