Appendix A

Species Listing PROPOSAL Form:

Listing Endangered, Threatened, and Special Concern Species in Massachusetts

Scientific name: *Bombus pensylvanicus*

Current Listed Status (if any): None

Common name: American Bumble Bee

Proposed Action:
__X__Add the species, with the status of: Endangered
_____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: Michael W. Nelson, Ph.D., Invertebrate Zoologist
Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries & Wildlife
1 Rabbit Hill Road, Westborough, MA 01581

Phone Number: (508) 389-6374
Fax:

E-mail: mike.nelson@state.ma.us

Association, Institution or Business represented by proponent: Massachusetts Division of Fisheries & Wildlife

Proponent's Signature: 

Date Submitted: March 2, 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, *Bombus pensylvanicus* (DeGeer, 1773) is a valid species (Williams et al. 2014, Ascher & Pickering 2016).

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

- The most recent record of *B. pensylvanicus* in Massachusetts is a specimen collected by J. Milam in 2012 (Richardson 2017a).

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

- Yes (Williams et al. 2014, Ascher & Pickering 2016).

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

- Although *B. pensylvanicus* has not been documented in Massachusetts since 2012, that and several other records from the Connecticut River Valley of Franklin and Hampshire Counties over the past decade indicate likely persistence of one or more population(s) in that part of the state (see Map 3 below).

(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, *B. pensylvanicus* is not listed under the federal Endangered Species Act.

(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?

- See Map 3 below. Records of *B. pensylvanicus* over the past 25 years indicate its persistence in the Connecticut River Valley region of Franklin and Hampshire Counties.

(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?

- *B. pensylvanicus* is a southern species, in the East ranging from southern Maine south to Florida, and west to Montana and Arizona; it is absent from much of the Mountain West, but found on the West Coast in Oregon and California (Williams et al. 2014). Massachusetts is at the northeastern edge of this species' geographic range.

(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?

- *B. pensylvanicus* is in decline in the northern parts of its range (Grixti et al. 2009, Cameron et al. 2011, Williams et al. 2014, Colla 2016).
- In Massachusetts prior to 50 years ago, *B. pensylvanicus* occurred in the Connecticut River Valley region of Franklin, Hampshire, and Hampden Counties, as well as in Middlesex and Norfolk counties, and in the southeastern part of the state on Cape Cod, the Elizabeth Islands, and Martha's Vineyard: see Map 1 below. During the 25 years from 1968 to 1992, it was not recorded in Norfolk County or on Cape Cod or Martha's Vineyard: see Map 2 below. During the past 25 years, it has become restricted to the Connecticut River Valley region of Franklin and Hampshire Counties: see Map 3 below.
- Surveys of Penikese and Cuttyhunk Islands in 2009 documented this species' disappearance since the 1970s (Stage 2009); similarly, an intensive bee survey in 2010 and 2011 documented this species' disappearance from Martha's Vineyard (Goldstein & Ascher 2016). In 2017, bee surveys on inner Cape Cod (Veit 2017), as well as *Bombus* surveys on outer Cape Cod (Richardson 2017b) failed to redocument this species.

(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.

- Species of *Bombus* respond differently to various threats (Williams et al. 2014). Three categories of threats likely affecting *B. pensylvanicus* in Massachusetts are listed below. *B. pensylvanicus* is a long-tongued species dependent on plant species with long, tubular flowers (R. Gegear, pers. comm.).

(1) Habitat loss or degradation
    - Habitat loss
        - Urbanization, conversion to intensive row crop agriculture or other non-habitat
        - Succession and afforestation
    - Habitat degradation
        - Loss of native floral diversity to adverse landscaping practice, agricultural intensification, succession, or excessive deer browse

(2) Pathogens introduced via commercially propagated bumble bees (Colla et al. 2006, Colla & Packer 2008, Otterstatter & Thomson 2008, Cameron et al. 2011, Graystock et al. 2013, Colla 2016)
    - The microsporidians *Nosema bombi* and *N. ceranae*

- The protozoans *Apicystis bombi* and *Crithidia bombi*

(3) Pesticide use (especially neonicotinoids) where habitat overlaps or interfaces with agricultural or landscaped areas (Whitehorn et al. 2012)

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

- As a group, species of *Bombus* are relatively generalized in habitat requirements and floral resource needs as compared to many other bees. However, *B. pensylvanicus* is a long-tongued species dependent on plant species with long, tubular flowers (R. Gegear, pers. comm.).
- *B. pensylvanicus* may be found in grasslands, fields, pastures, and other farmlands, as well as suburban yards, parks, and gardens. However, *habitat must provide a diversity of native flora blooming throughout the growing season, and threats such as introduced pathogens or pesticide use must be sufficiently diffuse or absent*. Within such habitat, this species typically nests on the ground surface in tufts of long grass or piles of cut grass or hay.
- Queens of *B. pensylvanicus* begin activity later in the season than most *Bombus* species (Grixti et al. 2009), a trait that may confer greater susceptibility to decline (Williams et al. 2009).

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:

(a) State distribution, number of occurrences (populations), population levels, and/or reproductive rates
(b) Amount of protected habitat and/or number of protected occurrences
(c) Management of protected habitat and/or occurrences

- When all three of the following goals are met, *B. pensylvanicus* should be evaluated for potential down-listing to Threatened or Special Concern (or delisting):
  (1) State distribution that includes the two currently occupied counties (Franklin and Hampshire), plus reestablishment (or rediscovery) in Dukes County and at least two of the following counties: Barnstable, Hampden, and Plymouth.
  (2) Number of current (within past 25 years) occurrences ≥20, where one occurrence is defined as one or more mapped record(s) in the NHESP database within 500 m of each other, and separated from other occurrence(s) by at least 500 m.
  (3) A minimum of half of current (within past 25 years) occurrences within habitat that is both protected conservation land *and* managed in a manner expected to maintain persistence of this species.

Literature cited, additional documentation, and comments.

Ascher, J.S., and J. Pickering. 2016. Discover Life bee species guide and world checklist (Hymenoptera: Apoidea: Anthophila). http://www.discoverlife.org/mp/20q?guide=Apoidea_species.

Cameron, S.A., J.D. Lozier, J.P. Strange, J.B. Koch, N. Cordes, L.F. Solter, and T.L. Griswold. 2011. Patterns of widespread decline in North American bumble bees. *Proceedings of the National Academy of Sciences* 108(2): 662-667.

Colla, S.R., M.C. Otterstatter, R.J. Gegear, and J.D. Thomson. 2006. Plight of the bumble bee: pathogen spillover from commercial to wild populations. *Biological Conservation* 129(4): 461-467.

Colla, S., and L. Packer. 2008. Evidence for decline in eastern North American bumblebees (Hymenoptera: Apidae), with special reference to *Bombus affinis* Cresson. *Biodiversity and Conservation* 17(6): 1379-1391.

Colla, S.R. 2016. Status, threats and conservation recommendations for wild bumble bees (*Bombus* spp.) in Ontario, Canada: a review for policymakers and practitioners. *Natural Areas Journal* 36(4): 412-426.

Goldstein, P.Z. and J.S. Ascher. 2016. Taxonomic and behavioral composition of an island fauna: a survey of bees (Hymenoptera: Apoidea: Anthophila) on Martha's Vineyard, Massachusetts. *Proceedings of the Entomological Society of Washington* 118(1): 37-92.

Graystock, P., K. Yates, S.E. Evison, B. Darvill, D. Goulson, and W.O.H. Hughes. 2013. The Trojan hives: pollinator pathogens, imported and distributed in bumblebee colonies. *Journal of Applied Ecology* 50(5): 1207-1215.

Grixti, J.C., L.T. Wong, S.A. Cameron, and C. Favret. 2009. Decline of bumble bees (*Bombus*) in the North American Midwest. *Biological Conservation* 142(1): 75-84.

Otterstatter, M.C., and J.D. Thomson. 2008. Does pathogen spillover from commercially reared bumble bees threaten wild pollinators? *PLoS ONE* 3(7): 1-9.

Richardson, L. 2017a. Bumble Bees of North America [unpublished database]. Gund Institute for Environment, University of Vermont, Burlington, Vermont.

Richardson, L. 2017b. Rusty-Patched Bumble Bee Inventory, Barnstable County, MA. Report to Tetra Tech, Inc., Portland, Maine.

Stage, G.I. 2009. Survey of the bees (Hymenoptera: Apoidea) of Penikese and Cuttyhunk Islands. Report to the Natural Heritage & Endangered Species Program, Massachusetts Division of Fisheries & Wildlife, Westborough, Massachusetts.

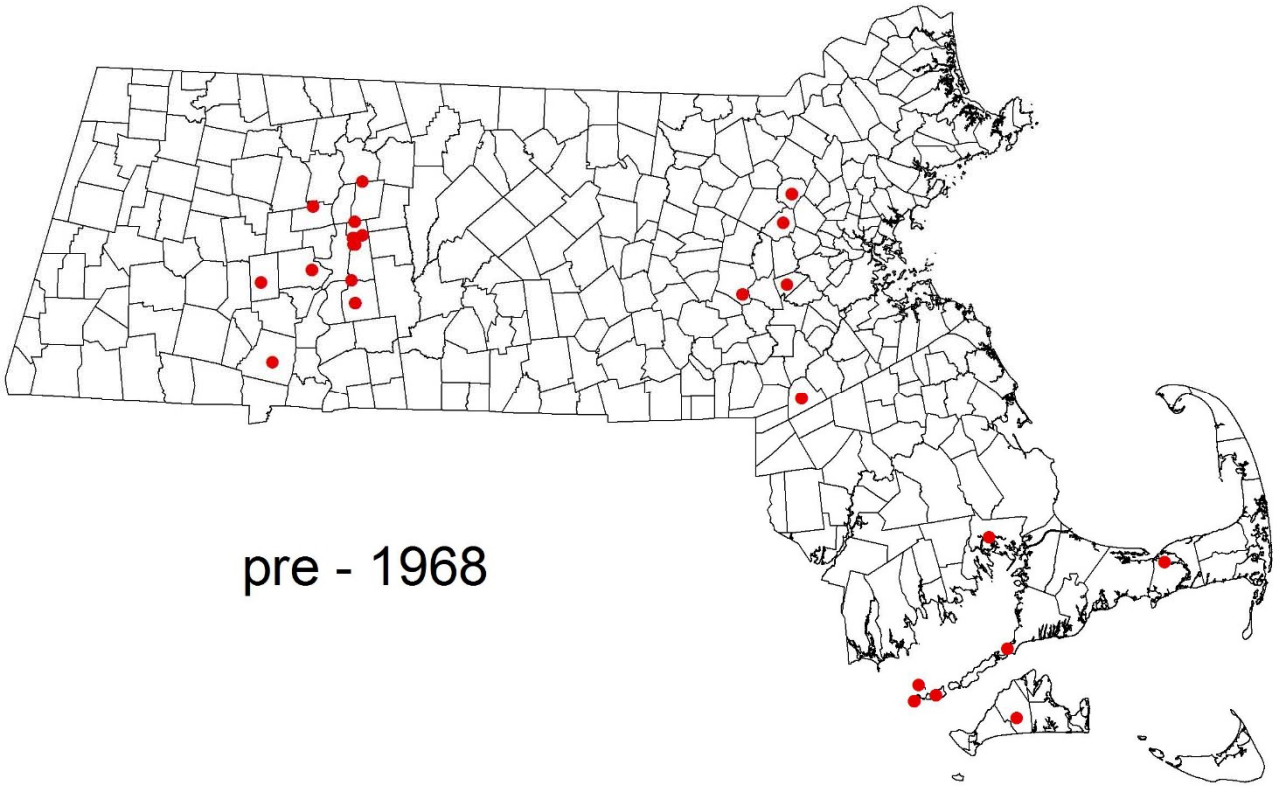
Veit, M. 2017. 2017 Camp Edwards Bee Survey. Report to the Camp Edwards Natural Resources Office, Sandwich, Massachusetts.

Whitehorn, P.R., S. O'Connor, F.L.Wackers, and D. Goulson. 2012. Neonicotinoid pesticide reduces bumble bee colony growth and queen production. *Science* 336(6079): 351-352.

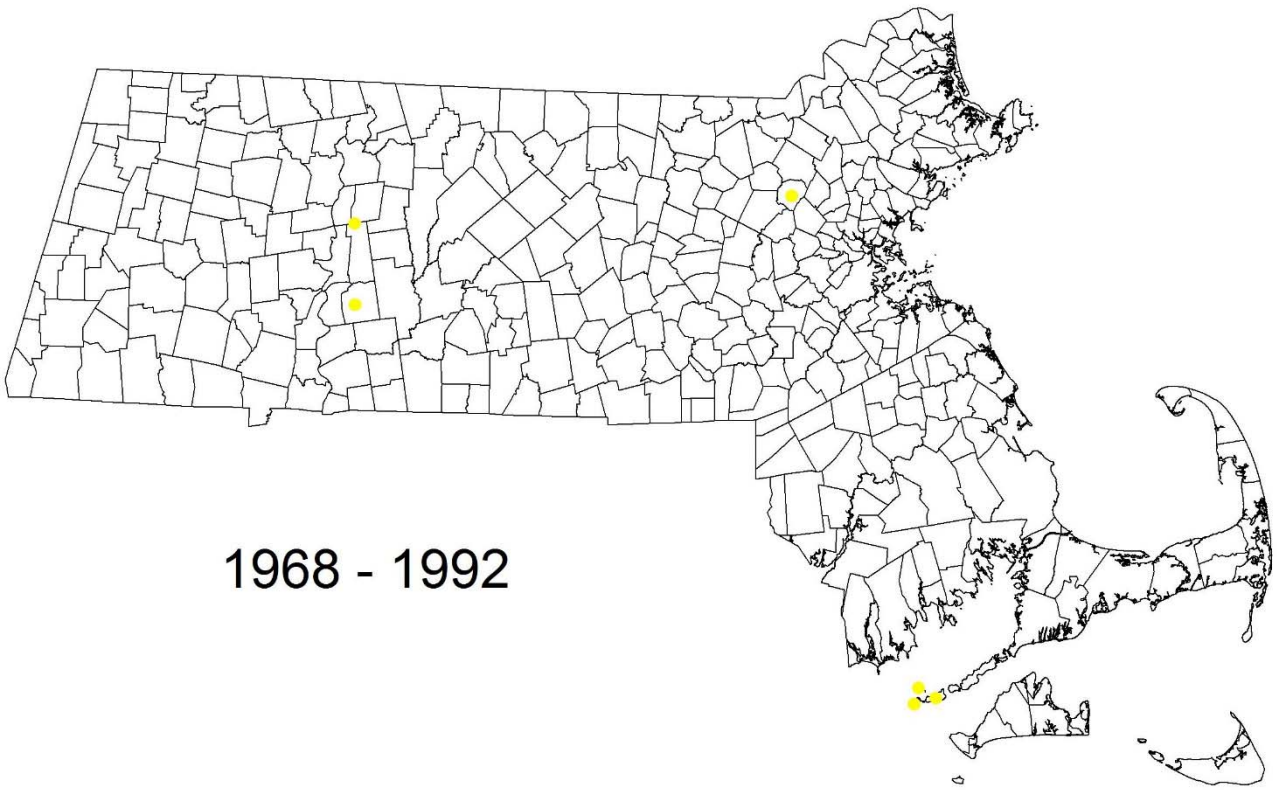
Williams, P., S. Colla, and Z. Xie. 2009. Bumblebee vulnerability: common correlates of winners and losers across three continents. *Conservation Biology* 23(4): 931-940.

Williams, P., R. Thorp, L. Richardson, and S. Colla. 2014. *Bumble Bees of North America*. Princeton University Press, Princeton, New Jersey. 208 pp.

Map 1. Records of *Bombus pensylvanicus* in Massachusetts prior to 1968 (more than 50 years ago). Data from Richardson (2017a), Ascher & Pickering (2016), Michael Veit, and Fred Morrison.



Map 2. Records of *Bombus pensylvanicus* in Massachusetts from 1968 to 1992 (25 years). Data from Richardson (2017a), Ascher & Pickering (2016), Michael Veit, and Fred Morrison.



Map 3. Records of *Bombus pensylvanicus* in Massachusetts from 1993 to 2017 (past 25 years). Data from Richardson (2017a), Ascher & Pickering (2016), Michael Veit, and Fred Morrison.